THE AMERICAN QUARTERLY JOURNAL OF AGRICULTURE AND SCIENCE,

CONDUCTED BY

DRS. E. EMMONS AND A. J. PRIME.

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ACKNOWLEDGMENT.

WE take this opportunity to acknowledge our obligations to the numerous papers, both those devoted to the agricultural, as well as other interests, throughout the country, for the kind and complimentary manner in which they have noticed the enterprise in which we have embarked. They are aware of the difficulties attending our situation, and of course will appreciate the value of our labors, and be able to make all due allowances for any deficiencies in the outset.

As the Editors reside in different places, they would state, that agricultural papers wishing to exchange with this Journal, will confer an additional favor by sending a copy of their paper to Albany and Newburgh.

E. EMMONS, *Albany*,
A. J. PRIME, *Newburgh*.

ERRORS.

On page 223, 10th line from the bottom, for "our," read "one."
On page 246, 3d line from the bottom, for "they never," read "the newer."
On page 247, 7th line from the top, for "plant," read "planet."
In note on same page, for "vessels," read "vescicles."
On page 250, for "tripunctuta," read "tripunctata."

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VOLUME I—NUMBER 1.

Farmers' Miscellany.

Miscellanies:

TO THE PUBLIC.

An attempt at the present time to establish a Quarterly Journal of Agriculture and Science will perhaps be looked upon by many as premature, and as likely on that account to incur a failure of patronage; or it may even be regarded as unnecessary and uncalled for, so far as it proposes to administer to the general or specific wants of an agricultural community. But a watchful attention to the progress of agriculture for the last ten years, and to the numerous and important discoveries made in the collateral sciences during that period, has inspired us with confidence in the usefulness and ultimate success of our undertaking, and induced us to put in execution the means within our reach for its advancement. To enable our patrons and friends to form an opinion on the utility of the publication we propose to issue, a detailed statement of its scope and design is here exhibited.

The leading features of the Journal will be agricultural. Whatever bears directly or indirectly upon the pursuit of farming, as a matter of course, comes within our plan, and within the legitimate field of our labors. We intend, however, to advocate that system of cultivation which is best adapted to this country. While British and other foreign husbandry will receive a full share of attention, we hope not to be considered singular in the expression of the opinion that the interests of the American farmer should not be identified with those of the European landholder, and cannot always be best promoted by pursuing those methods which are found successful abroad. We are aware, when we speak of Ameri-

can farming as differing in character from that of England and other foreign countries, that the distinction is not so much founded upon essentially different principles, as upon position and circumstances; for the principles of the science have a general application; the means and methods for procuring large and bountiful returns from the earth, and for improving and perfecting the different kinds of stock, are the same here as in England or France: they are founded on general and immutable laws. The food of plants consists of the same elements every where, whether these plants grow in valleys or on mountains, in the warm sunny regions of the south or the cold frosty regions of the north, and the laws of life which govern the vegetable and animal kingdoms are the same in all latitudes and climes. The agents which modify organic bodies, and under whose influence they grow up and decay; by which they are nurtured, and by which they fulfil their destiny, operate uniformly the world over. Heat, light, electricity, and water, awaken every where the dormant forces of the vital atom, and call into action a principle which had lain in a state of rest in the seed or in the bud: they sustain the energies of the being they have just stimulated into life, and maintain its growth and development from the period of its first vital movement through all the stages it has to pass to reach its maturity. The laws, then, by which these changes are effected, and by which the progress of all organized beings to their proper perfection may be either hastened or retarded, vary not: they are fixed and stable. The glorious sun, shedding his bright rays upon the mountain forest and upon the herbs of the valley, transforms and vitalizes the fluids and elements which circulate in the leaf; and this transformation is a necessary result, wherever the conditions of sunlight and vegetation exist. It is a terrestrial law, which reigns wherever vegetables grow, or wherever they are formed upon a terrestrial plan. The leaves of plants turn green in the light of the sun, the yellow rays of that luminary converting the colorless sap into the substance termed *chlorophyl*; and this is a law of light. Can we break this

law? No! But although we cannot break any of nature's laws, we may sometimes evade or counteract them. We may spread a curtain over the plant in a garden, or interpose a screen between the sun and the leaves of an herb; and by this arrangement, even although all other conditions necessary to growth are applied, we shall notably interrupt the decomposition requisite to the production of color in the vegetable tissue, and give place to a blanched, etiolated, and imperfect being. But the special mode by which this and all other changes are effected in vegetation are the same every where; so that whether we wish to produce, or to destroy, the law is at our hand: if we know the effect abroad, we are sure of the same effect at home. It is for these reasons, and in them we find cause for admiration, that the modes and rules of culture which are successful in one place, will be successful in all other places, provided we adapt them to the varying conditions of climate and situation.

But to return to the subject of American husbandry. We believe it ought to differ from the English system in some of its specific productions. The English cultivator, for instance, impelled by the humidity and comparative coolness of his climate, which favor the growth of the turnip and other root crops, employ these articles very extensively in sustaining and fattening their cattle. Now the American farmer is not driven to the use of these watery products. Our Indian corn, or maize, ought to be the principal food for fattening our domestic animals. The *zea mays* is the very prince of vegetables: its seeds or kernels furnish, to the live stock which feed on it, an abundance of oil or fat to line the cellular tissue, of fibrin to enrich the blood and enlarge and strengthen the muscles, of the phosphate of lime to give solidity to the bones, and indeed of all the elementary principles requisite to the due performance of the functions of nutrition and respiration. A field of maize, with the tall stems of the plants waving in the gentle summer breeze, and spreading their long pointed leaves to the brilliant light of an American sky; or with the autumnal stalks

bending under the weight of the golden grain of the ripened ear, forms a glorious rural spectacle, and is that crop which of all others clothes the husbandman's landscape in its richest beauty. But this plant owes all its importance to its intrinsic value as an article of food; and could the English farmer grow it, his turnip crop would be comparatively but little esteemed. In this connection, we hesitate not to say, that we regret that many of our agricultural writers advocate the culture of the root crops in imitation of the English system of husbandry, in preference to that of maize, which is so well adapted to our superior climate.

The condition of the American farmer differs from that of the same class in any other country. He is not only the owner of the soil, but he works it with his own hands. Let not this condition be changed. He may be comparatively poor: he has not his thousands to spare for the purchase of compost, nor his hundreds to pay for the erecting of brick and mortar fences. For his labor he requires a speedy return: indeed this is often indispensable for his own and his family's comfort. We do not mean by this remark to advocate what has been termed the *skinning process;* but as our farmer is not wealthy, and as he performs his own work, his returns are wanted when his crops are harvested. His true policy in cultivation is, notwithstanding, the preservative policy: his system must still be that which husbands the strength of the soil.

It is moreover the peculiar lot of the American farmer to be placed in proximity to vast and rich forests, superior to anything in the old world; with a soil deep and black, the debris of numerous ancient generations of organized beings both vegetable and animal, intermixed with the fine silt of rivers and lakes. The compost heaps of the English farmer can hardly vie with the rich soil which is spread by the hand of nature over the western prairies and beneath the western forests. For this reason, the older and partially exhausted soils of the Atlantic slopes must come in competition with the new and exuberantly rich soils of the west under a great disadvantage, particularly in the cultivation of some

of the staple productions. The western farmer spreads his wheat broadcast over thousands of acres. In those wide-spreading fields, no fence interrupts the wave of the bending grain as the breeze glides over its surface; and such are the facilities for the transportation of produce, that wheat and flour are poured upon the Atlantic board, as from an inexhaustible magazine which has been accumulating its treasures for ages. Towards this almost boundless territory, the tide of emigration continually sets; and from thence an untiring industry sends back to the less fertile regions the products of her labor, as from an overflowing granary, in such profusion that the drill husbandry, from which the largest returns are derived, can scarcely hope to compete. Still, let but new avenues of industry be opened, and if ever two days' labor are required to grow that which in the west requires only one, the east need not yet despair of securing wealth and prosperity under the influence of her indomitable perseverance, and in the multitude of resources at her command.

From this discussion, we return once more to the consideration of the proper object of our Journal. Especially we wish it to be understood that we aim to promote the advancement of that system of husbandry which shall be the most profitable, and the best adapted to circumstances when all the peculiarities of location and place are taken into consideration, together with the competitions which spring up between rival communities, the plans of industry which may be devised, the special kinds of stock and produce which the markets of the day may require, and, in fine, all those conditions which modify personal and general interests when viewed in their broadest bearings, and as they most affect the prosperity of the American farmer. The present is distinguished from the past by a wonderful energy in prosecuting scientific research. Not only are old fields broken up anew, but new ones are entered with astonishing zeal. The impetus which is thus given to discovery, in all countries where intelligence has a vigorous reign, can hardly be conceived by one who has not a good share of industry

in his readings, or who does not make it his business to post up facts of the preceding years. The American farmer and gentleman, then, who beyond all other men is most interested in the progress of knowledge, will do himself injustice if he neglect the opportunity and means of becoming acquainted with those discoveries which the indomitable energy of the present age is continually making. It may appear, to be sure, that there is an extraordinary eagerness for discovery in pure science, but that this does not become of much practical importance. This, however, is not the true view; for such is the utilitarian spirit of the age, that no sooner has a discovery been made, than it is appropriated to some of the branches of industry: every thing is caught up and applied to the promotion of the arts, or the improvement of domestic economy.

We would not incur the charge of prolonging this address unnecessarily, but wish yet to say a few words as to the means we possess, and may command, to enable us to carry out the plan of our work. Many gentlemen of both practical and scientific acquirements, who are especially occupied in researches for the advancement of science and agriculture, are already engaged as contributors to our Journal. Our own individual connection with the geological and agricultural surveys, has placed within our reach much important matter relating to agriculture, both in this and other States of the Union. We propose also to extend our researches south and west, for the purpose of seeking out new sources of information on subjects most interesting and useful in the sphere of our labors, and of rendering our publication what its title imports, a Journal of American Agriculture. It will be our personal endeavor to multiply the means for increasing the products of the earth, and to encourage the prosecution of those inquiries which may lead to the discovery of new sources of the fertilizing agent, particularly the phosphates and carbonates, the inorganic elements which constitute so essential a portion of many of our most valued vegetable productions. This inquiry is scarce-

ly begun in this country; and though we may be disappointed in our expectations from it, we believe no one will venture to deny its importance and necessity. But while we thus explicitly state the main scope and range of our work as it regards agriculture, we wish it to be understood that we do not design to confine it wholly to this department. We intend to record the discoveries, and to lay before our readers the most interesting facts, in science at large, so far at least as our pages will admit; always, however, aiming at judicious selection, and extending only so far as may enable our readers to keep pace with the progress of knowledge. It will be a part of our object to give occasional abstracts of the proceedings of scientific bodies, and notices and reviews of new publications. Without attempting a dogmatic course, we shall assume the right to express our opinions on matters pertaining to the subjects discussed in the journals and other scientific publications of the day; always, however, with a proper respect for the views and opinions of others, and under the conviction that we are all liable to err.

In conclusion, we feel deeply the responsibilities of the task we have undertaken. We are not unaware of the labors we shall be called to perform if we are faithful, and wish to be useful; nor of the vexations and embarrassments which attend the conducting of a public journal. But we do not rely wholly upon our own resources and personal exertions. We respectfully solicit our friends, and all who feel interested in the promotion and diffusion of agricultural information, to aid us in this undertaking; and, at the same time, we are pledged to furnish at least a moderate remuneration to those contributors who may supply us with communications suitable to our pages.

E. EMMONS,
A. J. PRIME.

Albany, January, 1845.

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FOOD OF PLANTS.

BY THOMAS HUN, M. D.

If we put a seed into the earth, it will, under suitable conditions of moisture, heat, and light, germinate, grow and become a plant weighing many thousand times more than the original seed. Whence does it derive the materials out of which its substance is formed? In what shape do these materials exist before entering into its composition? In other words, what is the source of the food of plants, and what is the nature of this food?

As to the source of the food of plants, it is plain that it must be in the soil, or in the atmosphere, or in both, for with these alone is the plant placed in communication. The question remains, in what proportion does each of these contribute to the formation of the plant, and what particular constituents does each furnish?

The question of the food of plants is of great practical importance, for all agricultural processes have for their object to place plants in the conditions most favorable to their growth and development; and as a due supply of food is one of the most essential of these conditions, it follows that these processes must be

founded on a knowledge of the articles of food required by plants in general, and by each particular kind of plants.

Until a few years ago, the knowledge possessed on this point was so defective, that it furnished no certain basis for any system of agriculture, and all scientific farming was looked on with great distrust. It was considered safer to trust to a certain routine of practice which was found to work well in many cases, but the reason of which was unknown, than to have recourse to scientific principles which, however plausible they might seem, rarely led to any profitable application. But practices founded on blind routine must in many cases be misapplied, and the art pursued under such a system must remain stationary. Of the imperfection of the art of agriculture it is unnecessary to speak, and as to its improvement it may be affirmed with great truth that while all the other mechanical arts have been making such wonderful progress, this one, which occupies more men than all the rest together, has scarcely partaken of the movement, and that with the exception of some improvements of its instruments, for which it is indebted to other arts, it is now, in all essential respects, at the same point it was two thousand years ago.

Agriculture is however destined no longer to remain stationary. Recent improvements in organic chemistry are changing the whole aspect of vegetable and animal physiology, and rendering these sciences susceptible of practical application. The mode in which plants are supplied with food, and the kind of food they require, are becoming better understood, and the theory of manures is becoming more perfect; in a word, a science is springing up which will revolutionize the whole art of agriculture, and enable it to take its rank among the mechanical arts founded on fixed scientific principles. In a few years it will be considered as absurd for a man to undertake the management of a farm without having acquired a theoretical knowledge of agriculture as it would be to attempt to practice engineering without a knowledge of geometry.

In this paper, I propose to point out in as plain a manner as may be, what are the materials out of which the substance of plants is formed and the sources whence these materials are derived, and thus explain the action of various substances used as manures. I have nothing new to add to what is contained in the treatises of Liebig, Dumas and others, on this subject; I only hope

to call attention to their views and render them intelligible to a class of persons who do not possess the knowledge of chemical principles which these works suppose in their readers.

Let us first of all see what is the composition of the matters found in plants, and we will be better prepared to understand the nature of the food and the changes it undergoes.

A superficial examination of the composition of plants shows that they contain gum, starch, sugar and other matters of like nature, which are not found in the soil nor in the atmosphere. The plant must, then, by virtue of forces peculiar to itself, form these matters out of the materials it derives from these two sources.

But we must look more closely into the composition of plants.

If we burn a plant in the open air, a large portion passes off in the form of vapor of water and of gas, and a quantity of ashes remains.

This ash of plants which cannot be dissipated by heat, is found on analysis to be composed of salts of soda and potash, alumina, silex and other earthy and saline matters. These matters are essential components of the plant, but do not seem to have made part of its organized tissues. They are simply deposited in these tissues, and are called the *inorganic constituents of plants.* Liebig has called especial attention to their importance in vegetation.

Those parts which pass off in a gaseous state during combustion are the organized parts and organic products of the plant. If we collect these gases and this vapor, we find that on ultimate analysis they may all be resolved into four elements, carbon, oxygen, hydrogen and nitrogen. There are also some traces of sulphur and phosphorus.

We can thus arrive at the first grand division of the constituent parts of plants, viz., the inorganic constituents, composed of earthy and saline ingredients which remain after burning, in the form of ashes, and the organic matters composed of the four simple substances I have mentioned, and which pass off in the form of gas and vapor.

Carbon, oxygen, hydrogen and nitrogen are then the elements out of which all the organic matters of plants are formed; but these elements are combined in a manner very different from that in which they are combined in dead matter, and this leads me to

point out the difference between organic and inorganic combinations.

The chemist in his laboratory can obtain from starch, gum, albumen and other organic matters, the elements of which they are formed: he can separate them into carbon, oxygen, hydrogen and nitrogen, but he cannot by any means within his reach cause the elements again to combine so as to form these organic matters. These matters are formed only in the living plant and under conditions which the chemist cannot imitate.

Thus gum is formed from three elements, carbon, oxygen, hydrogen, united together in certain definite proportions. The chemist can cause these elements to unite in various ways; the oxygen and hydrogen will combine and form water, the oxygen and carbon will form carbonic acid, the carbon and hydrogen will form carburetted hydrogen. But he cannot by any possible means cause the three to combine and form gum.

So in the case of organic matters containing four elements, viz., carbon, oxygen, hydrogen and nitrogen. These elements will unite by ordinary chemical processes to form various compounds. The carbon and oxygen will form carbonic acid; the hydrogen and nitrogen will form ammonia, and these compounds will again unite to form carbonate of ammonia. But this substance is very different in its properties from albümen, which is found in living plants.

These compounds of the three or four simple substances which are formed only in the laboratory of the living plant, and which cannot be reproduced by the chemist from their elements, are called proximate principles. They are very numerous, and it is not necessary here to enumerate them, but for understanding what is to follow, the composition of the most important of them must be known.

Some of these proximate principles contain only three of the elements I have mentioned, and then these three are always carbon, oxygen and hydrogen. Others contain four elements, and then nitrogen is added to the above three. The former are called *non-nitrogenized*, the latter *nitrogenized* principles. This is a most important distinction, and its applications are numerous in vegetable and animal physiology.

Of the nitrogenized principles there is a class in which the oxygen and hydrogen exist in the proportions to form water, so that they

may be considered as compounds of carbon with water, or more properly with the elements of water, for it is not proved that water exists as such in them. This affords a convenient way of stating their composition.

		Carbon.		Water.
Starch,.........	=	12	+	10
Cane Sugar,.....		12	+	11
Gum,..........		12	+	11
Sugar of Milk,...		12	+	12
Grape Sugar,....		12	+	14

From this table it may be seen that these principles are convertible into each other, simply by adding or subtracting the elements of water. Some principles as, gum and cane sugar, are identical in composition though different in properties. Such instances of substances having different properties while their composition is the same, are also found in inorganic compounds. They are called isomeric. Their differences are supposed to depend on a different arrangement of their atoms.

Among the *non-nitrogenized* principles, there are others in which the oxygen and hydrogen are not united in the proportions to form water. These are the oils and acids.

The nitrogenized proximate principles are albumen, fibrin and casein; they are identical in composition with the principles of the same name found in animals. These three principles are nearly identical in composition, differing only in the proportions of sulphur and phosphorus which exist in them in very minute quantities. They may all be resolved into a principle called protein, composed of carbon, oxygen, hydrogen, and nitrogen, combined with sulphur and phosphorus.

Thus, fibrin,..	=	Protein	+	P.	+	2	S.
Albumen,....	=	Pr.	+	P.	+		S.
Casein,......	=	Pr.	+	S.	+		

These nitrogenized principles are of great importance in nutrition, since all the organized tissues of animals are formed from them. They are the only proper supporters of nutrition, and vegetable food is nutritive in proportion to the amount of nitrogenized principles it contains. The non-nitrogenized principles serve as supporters of respiration and not as supporters of nutrition.

Animals whose organized tissues are composed of these principles are incapable of forming them from their elements, and hence must receive them ready formed in the flesh of other animals or in vegetables. All the albumen, fibrin and casein now existing in animals must have previously existed in vegetables, which are the grand agents for forming organic compounds for the use of animals.

Plants contain then, two classes of substances:

1. Inorganic constituents consisting of salts of soda and potash, of silex, alumina, &c., which are deposited in, but do not form a part of the organized tissues. These constitute mainly the ashes of plants when burned.

2. Organic matter composed of three elements : carbon, oxygen, and hydrogen—or of four elements, nitrogen being added to these three. These elements are united together in the living plant under conditions which cannot be reproduced by any artificial means, and form what are called proximate principles.

Now that we have an idea of the composition of plants, we proceed to the consideration of their food.

As we have established two classes of substances entering into the composition of plants, viz., the organic and the inorganic matters, so we may establish a corresponding division of their food. I will consider each of these divisions separately.

1. Of the materials out of which the organic matters or proximate principles of plants are formed.

There are four articles of food out of which plants form all their proximate principles or organic constituents. They are

1. Water, composed of hydrogen and oxygen.
2. Carb. acid, " " carbon and oxygen.
3. Ammonia, " " nitrogen and hydrogen.
4. Nitric acid, " " nitrogen and oxygen.

It will be seen that the two first of these substances (water and carbonic acid) contain the elements of the non-nitrogenized principles of plants. For if from the carbonic acid we subtract the oxygen, we have carbon remaining, which by its union with the elements of water in different proportions, forms starch, gum, sugar and the other principles of that class.

For the formation of the nitrogenized principles we must have, in addition to these elements, nitrogen, which is derived from ammonia or from nitric acid.

Those substances which constitute the food of plants, are derived from the soil and from the atmosphere. Formerly, great importance was attached to the soil, as furnishing materials for the organic constituents of plants. It has been shown however, from more recent researches, that the atmosphere is the great reservoir of food, and that the supply derived from the soil though in several respects important, is comparatively small.

The atmosphere is composed principally of two gases, oxygen and nitrogen, in the proportions by volume of 208 of the former to 792 of the latter. It contains also $\frac{1}{2500}$ by volume of carbonic acid gas, and a variable quantity of watery vapor. Besides this, it is constantly receiving ammonia from animal decomposition and animal excrements, but by reason of the solubility of this gas in water, it unites with the vapor and is thus carried to the earth in the form of rain and snow. Although the amount of ammonia in the atmosphere is too small to be detected by chemical analysis, yet its presence in snow and rain proves its existence there, and besides we know that from various sources it is constantly passing in the atmosphere.

Carbonic acid, ammonia, and water, are the constituents of the atmosphere which afford nourishment to plants. The proportion in which they exist is small, but when we take into account the immense extent of the atmosphere, we find their absolute amount to be very great.

The composition of soils is more variable than that of the atmosphere. In a general way, it may be said that the soil consists of earthy and saline matters, which constitute its basis, and are derived from the disintegration and decomposition of rocks, and of a quantity of vegetable matter called vegetable mould or humus. This matter during its decomposition, gives out carbonic acid. Besides these, soils contain matters derived from the atmosphere, such as water impregnated with carbonic acid and with ammonia.

According to Liebig, the great value of the soil for vegetation depends on its earths and alkalies, which seem to supply the inorganic constituents of plants. The humus or mould is comparatively unimportant except at certain stages of vegetation, in furnishing carbonic acid to the roots.

I shall now proceed to examine each of the articles of food I have enumerated.

1. *Water.* This substance is also a necessary ingredient in the food of animals, but in them it serves the purpose of a diluent or solvent of the alimentary principles, and does itself contribute directly to nutrition. It serves this same purpose of a solvent also in plants, for the carbonic acid, the ammonia and the inorganic constituents are introduced in a state of solution in water. But water is also directly nutritive in plants; its elements combine with the carbon of the carbonic acid and form the non-nitrogenized proximate principles.

The part played by water in vegetation is then doubly important, for it not only serves as an indispensable article of food which is converted into the substance of the plant, but by its solvent properties it serves to introduce the other articles of food from the soil and from the atmosphere.

The necessity of water for vegetation and the sources whence it is derived, are so generally understood that they require no further illustration.

2. *Carbonic acid.* Carbon is the preponderating element of plants, constituting more than fifty per cent of their weight. It is introduced in the form of carbonic acid, which is derived from the soil and from the atmosphere.

The carbonic acid derived from the soil is absorbed by the roots, passes into the trunk and from thence into the leaves and ends by being exhaled, without change, if no new force intervenes.

"Such is the case with plants vegetating in the shade and during the night season: the carbonic acid of the soil permeates their tissues and is diffused in the air. Plants are commonly said to produce carbonic acid during the night; this is incorrect: plants then only transmit unchanged the carbonic acid which their roots have pumped up from the soil.

"But suppose this carbonic acid, whether derived from the soil or from the atmosphere, to be in contact with the leaves and green parts, and the light of the sun to fall on them, immediately the whole scene is changed: the carbonic acid disappears; minute bubbles of oxygen are evolved from every point of the leaves and the carbon is fixed in the tissues of the plant.

"And it is a point most worthy of remark and fitted to arouse attention, that these green parts of vegetables, the very ones that have been found capable of exhibiting this wonderful phenome-

non, the decomposition of carbonic acid, are also possessed of another property, not less peculiar, not less mysterious.

"If we attempt to transfer their images to a prepared plate of the apparatus of M. Daguerre, the green parts are found not to be reproduced, not to be formed; it is as if the whole of the chemical rays essential to the photographic phenomenon had disappeared, had been absorbed and retained by the leaf.

"It would seem, therefore, that the chemical rays of light vanish entirely in the green parts of plants—an extraordinary absorption without doubt, but easily explained when the enormous expenditure of chemical force necessary to the decomposition of a substance so stable as carbonic acid is required.

"Let us next inquire concerning the part played by the carbon thus wonderfully fixed by vegetables. What is its business—what its destination? For the major part unquestionably, it combines with water or its elements, and it thus gives origin to substances of the highest consequence in the economy of plants.

"Twelve atoms of carbonic acid being decomposed and abandoning their oxygen, there will result twelve atoms of carbon, which, with ten atoms of water, will compose either the cellular or the ligneous tissue of plants, or the starch and dextrine which are their derivatives."*

Such is the important part which is played by carbonic acid as an article of the food of plants. Introduced into their interior, whether by the roots or by the leaves, it is, under the influence of the sun's rays, decomposed in the green parts, its carbon remains in the plant and the oxygen is exhaled into the atmosphere. The carbon then unites with the water or its elements, and forms starch, sugar, gum and the other non-nitrogenized principles.

The action of plants is in this respect precisely the reverse of what takes place in animals. The latter consume the carbon in their food, which ultimately combines with the oxygen introduced by the lungs, and is converted into carbonic acid, which passes into the atmosphere, and is by plants again resolved into carbon and oxygen. For this reason plants have been called apparatus of reduction, and animals apparatus of combustion.

The carbonic acid is derived from the soil, where it is genera-

* Dumas' Balance of Organic Nature.

ted by the decomposition of vegetable matter, and from the atmosphere. The main source of carbonic acid is, however, the atmosphere. "How can this be otherwise when the enormous quantities of carbon which trees, the growth of centuries, for example, have laid up, are contrasted with the very limited extent to which their roots extend? Very certainly where the acorn, whence sprung the oak which is now our admiration, germinated a hundred years ago, the soil where it fell and struck not did not contain the millionth part of the charcoal which the oak now incloses. It is the carbonic acid of the atmosphere which has furnished all the rest; that is to say, almost the whole mass of the noble tree."

"But what can be more clear or conclusive upon this subject than the experiment of M. Boussaingault, in which peas sown in sand, watered with distilled water and fed by the air alone, nevertheless found in this air all the carbon necessary to their development, flowering and fructification."*

Liebig has insisted strongly on the fact that the vegetable mould is of much less consequence in furnishing carbonic acid to the nits of plants than has been previously supposed. According to him, this vegetable mould is more important as furnishing the inorganic constituents of plants in a soluble state than as furnishing carbonic acid.

Plants are, however, dependent to a great extent on the carbonic acid of the soil. During germination the plant derives its nourishment from the supply laid up in the seed. By the time this supply is exhausted the roots and first green leaves are formed. The latter organs can now take in carbonic acid from the atmosphere, but the quantity absorbed will be in proportion to their surface, which is very small. If then the plant is vegetating in a soil which furnishes no carbonic acid to the roots, so that the whole supply must be derived from the atmosphere by its leaves, its early growth will be slow and the season far advanced before it arrives at maturity. But if the roots can take in carbonic acid the process of growth is more rapid, the leaves are formed in greater abundance, and as the leaves increase, the capacity for taking in carbonic acid from the atmosphere is increased, and thus

* Dumas' Balance of Organic Nature.

the growth of the plant is accelerated, not only by the amount of absorption by the roots, but also by the increased absorption by the leaves.

On this depends the importance of furnishing to young plants in the spring of the year manures capable of furnishing these nits with carbonic acid. For the same reason the earth is broken up to admit air to vegetable matter of the soil, and thus favoring its decomposition, during which it gives off carbonic acid. When the roots are thus freely supplied with carbonic acid, the plant sends out leaves which themselves are organs for introducing nutritive matter from the atmosphere. We thus gain time, so important for a crop which is to be produced in a single season, but which is of little moment to forest trees which are to continue during a long succession of seasons.

Ammonia or Nitric acid.—This is the third article of food for plants. It furnishes the nitrogen they contain.

Carbonic acid and water contain the elements of all the non-nitrogenized principles of plants. The nitrogenized principles, fibrin, albumen, and casein, require the concurrence of nitrogen, which can only be introduced in the form of nitric acid or some salts of ammonia.

Although plants are surrounded by an atmosphere containing seventy-nine per cent of nitrogen, yet they are incapable of introducing and assimilating it in that form. Some experiments of Boussaingault, which seem to him to prove that plants abstract nitrogen from the atmosphere, admit of being differently explained. It is more probable that the nitrogen was obtained from the minute quantity of ammonia in the atmosphere.

Wild plants contain less of the nitrogenized principles than those which are cultivated for food. Indeed, the value of vegetable products as food for animals, depends mainly on the quantity of nitrogenized principles they contain.

One of the great problems in agriculture, is to furnish plants with a supply of nitrogen at a cheap rate. Water and carbon are in general provided by nature in sufficient abundance; and for wild plants, ammonia is furnished sufficiently from the sources I will presently point out. But for plants which are cultivated with reference to the amount of nitrogenized principles they contain, it

is necessary to surround the roots with manures containing an additional amount of nitrogen.

Let us now see what are sources whence the ammonia is derived for the use of plants.

The flesh of animals, and a large portion of the blood, consists of nitrogenized principles, fibrin, albumen, gelatine, which during its decomposition after death, gives off the nitrogen in the form of carbonate of ammonia.

During life, the animal tissues are continually undergoing a change, receiving new matter from the products of digestion, and giving up their old materials which are thrown off in the excretions from the lungs and kidneys. By the former, (the lungs,) is thrown off the carbon, in the shape of carbonic acid, and by the latter, (the kidneys,) the nitrogen in the shape of urea, which by exposure to the atmosphere, is speedily converted into carbonate of ammonia.

Thus it is that all the nitrogen which enters into the food of animals, and which is directly or indirectly furnished by plants, after making part of the living tissue of the animals, is ultimately restored to the atmosphere in the shape of ammonia, or its carbonate.

Just as animals consume the carbon of vegetables, and afterwards restore it to the atmosphere in the shape of carbonic acid, that is in a shape adapted for vegetable nourishment, so do animals restore the nitrogen they consume in their food to the atmosphere, in the shape of carbonate of ammonia, which again serves for the nourishment of vegetables.

The ammonia or carbonate of ammonia, which is thus disengaged from animals after death, and from their excretions during life, being volatile, passes into the atmosphere. By reason of its affinity for water, it combines with the vapor of the air, and descends to the earth in the form of rain or snow, and is applied to the roots of plants. Ammonia never exists in the atmosphere in sufficient quantity to be detected by chemical analysis, but its presence in rain and snow water, proves that it must have previously existed in the atmosphere.

Plants, also, can absorb ammonia directly from the atmosphere by means of their leaves. This seems to be proved by the experiments of Boussaingault, to which I have before alluded. He

found that some kinds of plants in a soil of pure silex, moistened with distilled water, were capable of growing and forming nitrogenized compounds. In this case the nitrogen must have been derived either from this gas as it exists in the atmosphere, or from the ammonia which is present in very minute proportion. The latter explanation is on many accounts the most probable.

According to Dumas, nitrate of ammonia is also generated by a combination of its elements, by the action of electric sparks in thunder storms, which is carried to the earth by the rain.

From these sources ammonia is constantly passing into the atmosphere for the support of the vegetation in the earth. But this general supply does not furnish a sufficient proportion for cultivated plants, and hence the necessity of manures, which are capable of producing it in greater abundance.

The manures which furnish the most abundant supply of ammonia, are urine and the excrements of animals, but particularly the former. But owing to the volatility of the carbonate of ammonia which is generated by the manures, it is liable to pass at once into the atmosphere, instead of contributing to the nutrition of the plants around whose roots it is deposited. Different modes have been proposed for fixing this ammonia, by converting the carbonate into a salt which is not volatile. This is effected by adding some mineral acid, such as sulphuric or muriatic, which gives rise to a sulphate or muriate of ammonia, which is not volatile, and remains permanent, so that the whole of it may be absorbed into the plant. The addition of these acids has the further advantage of destroying the ammoniacal smell of putrid urine, and for these two reasons it is resorted to in the manufacture of poudrette.

According to Liebig* "the evident influence of gypsum (sulphate of lime) upon the growth of grasses—the striking fertility and luxuriance of a meadow upon which it is strewed, depends only upon its fixing in the soil the ammonia of the atmosphere which would otherwise be volatilized with the water which evaporates. The carbonate of ammonia contained in rain water is decomposed by gypsum in precisely the same way as in the manufacture of sal ammoniac. Whether sulphate of ammonia and carbonate of lime are formed, and this salt of ammonia possessing no volatility, is consequently retained in the soil."

* Agricultural Chemistry.

"In order to form a conception of the effect of gypsum it may be sufficient to remark that 110 pounds of burned gypsum fixes as much ammonia in the soil, as 6,880 pounds of horse's urine could yield to it, even in the supposition that all the nitrogen of the urea and hippurci acid were absorbed by the plants, without the smallest loss in the form of carbonate of ammonia. If we admit with Boussingault, that the nitrogen in grasses amounts to $\frac{1}{100}$ of its weight, then every pound of nitrogen which we add increases the produce of the meadow 100 pounds, and this increased product of 100 pounds is effected by the aid of a little more than four pounds of gypsum.

INORGANIC CONSTITUENTS OF PLANTS.

All the organic parts of plants are formed by means of transformations which take place in the substances I have named, to wit, water, carbonic acid and ammonia, or nitric acid. But there are other constituents which also require notice.

In all plants there is a certain amount of mineral substances which remain after burning, in the shape of ashes. These substances vary in different plants, and are more abundant in some than in others. They consist, for the most part, of salts of soda and potash, silex, alumina, lime, magnesia and some others.

Liebig has insisted very strongly on the necessity of these mineral ingredients for plants, and has shown that no matter how abundantly a plant may be supplied with water, carbonic acid, and nitrogen, it will not flourish if the inorganic constituents are wanting. Thus wheat, rye, peas and beans, contain a large proportion of the alkaline and earthy phosphates, and will not flourish in a soil destitute of them, however rich it may be in other ingredients.

The inorganic constituents are originally derived from the disentegration and decomposition of the rocks which form the basis of the soil, and that portion of them which is removed with the crops must be restored in the shape of manures, or by allowing the ground to lie fallow while a new supply is generated by the further disintegration of the rock.

When lands are exhausted by successive crops, the exhaustion depends rather on the absence of the inorganic constituents than of the sources of carbonic acid and water. This exhaustion of the soil may be prevented to some extent, by raising successively crops

of substances requiring different constituents, and on this the system of alternation of crops is founded.

The principal source from which the soil is to be supplied with the inorganic constituents of plants, is the urine and excrements of animals and different animal remains. Urine contains a large proportion of alkaline and earthy phosphates, and on them depends its value as a manure, more than on the nitrogen it furnishes. The same is true of bones, which have been found to be so valuable as manures. After being buried a few years they contain no animal matter, and furnish only food for the inorganic constituents of the plant.

Guano is a substance which has recently been brought into use as manure. It consists of the excrements of birds which has accumulated for a great length of time, and it furnishes to plants both nitrogen, and alkaline and earthy phosphates.

These matters must not only be present in the soil, but must also be soluble in water, and several substances are employed as manures, the efficacy of which depends on their capacity of forming soluble combinations of the silex, alumina, &c.

WHAT IS TO BE DONE FOR AMERICAN AGRICULTURE?

Ever since the attention of agriculturists in England was awakened to the immense benefits to be derived to their noblest of arts, by the aid offered by science, there has been a vast amount of speculation afloat in this country upon the same subjects. If, instead of speculation, it had been the well grounded result of investigation and careful experiment, it would have been, even at this time, amply sufficient to have redeemed American farming, and placed it upon a secure and profitable footing. If the activity and zeal displayed, instead of being set to work loosely and without any definite object, had been first enlightened and then cautious—slow and prudent, and directed to particular results—if instead of being distributed over the whole broad field of agriculture at once, it had been guided with discretion to the improvement of some single branch of husbandry—the effects at this day would have been incalculable. Great revolutions, such as are necessary in

farming, cannot be produced in a day or a year. It is not sufficient only to inform and enlighten the few—to arouse here and there one to the task of personal reformation—it is not sufficient even, that the leading agriculturists of the country should be aroused to the application of new principles and practices—but in such a country as this the whole mass must work together in order to produce any result that will be appreciable to any but the closest observer. It is true that the tendency of knowledge, among a free people, is to spread and diffuse itself among all—yet when the prejudices, and those ingrained into the nature of the mass of American farmers, are considered—when it is remembered that they have to unlearn every thing in order to learn any thing—that a man must be convinced he is wrong before he will learn to do right—must be conscious of his ignorance before he will consent to be instructed—when all these circumstances are taken into the account, it cannot perhaps be matter of surprise to any that so little progress has as yet been made in this country in rational farming. As long as a man believes he has arrived at perfection, it is the veriest folly to try to improve him. It is a question then of no small importance—"What is to be done for American Agriculture?"

It is matter of congratulation, no less to the patriot and the political economist than to the farmer himself, that something has already been done. A different system is beginning to prevail, and although it may not appear to a superficial observer, yet by one who refers to the practices of former years and compares them with the present, much will be seen to convince him that farming is undergoing a slow and gradual but sure change for the better. Call it *rational—mental—scientific*, or what we will—its efforts are beginning to be felt and will continue to increase. We see this in the large tracts of land that have been and are being redeemed from waste—in the restoration, in some parts of the country, of exhausted soil—in the improvement of stock and the disposition to obtain improved breeds—in the multiplied production of better farming implements, which can only be made in such abundance to supply an increasing demand—but in nothing more than in the growing desire for information shown in the increase of agricultural papers and books. And we hail all these as indications of the dawning of a new era in farming.

In replying to the question at the head of this paper, we shall

consider only what individuals ought to do. The question of what government ought to do, will be examined at another time.*

I. The farmer must acquaint himself with the principles of his art. Its foundation is laid in knowledge, and its successful practice depends upon individual skill. Of late years the sciences have laid open vast resources for the farmer. Geology, Botany, and especially Chemistry, have already taken rapid steps towards revolutionizing the practice of agriculture. It no longer answers for a man to quote his father as the best authority. We must go higher now and follow the laws of *Nature*. Let us not be understood to mean that every farmer must become a chemist in the strict sense of the term, although to a certain degree he must be one. He is a practical chemist already, and he should be in a measure a theoretical one ; that is, he should be a *reasoning* man, in respect to the operations he carries on. He should be able to see the cause when a certain effect is produced, and to understand why the various processes which he follows are necessary, and what are wrong and what are right. This does not involve necessarily an acquaintance with all the technical terms of science, terms now so much the dread of the uneducated farmer. But he should understand the names of things he uses, and not ask the chemist who labors for his benefit, to perform the impossibility of finding names for substances which a man can comprehend without finding them out. Nothing is more common than this complaint, and nothing more wrong. A great beauty and excellence in the names applied by modern chemistry is, that for the most part, the name of the substance defines and explains its composition, so that by seeing the name of a compound we know of what it consists. Take an example—the acid commonly called "oil of vitriol." This is an unmeaning term, and conveys no idea of that substance any more than if it were written in the Chinese tongue. But the name "sulphuric acid," which is the proper one, indicates at once that sulphur is the essential ingredient, and a slight knowledge of chemistry tells us that oxygen is the other. The farmer is familiar with "plaster of Paris ;" does he know such a substance as "sulphate of lime ;" a name which at least shows the presence of sulphur and lime ! On the contrary, fault is often

* An able article on this subject will be found on another page.—Eds.

found with writers because they will call it gypsum; a name sufficiently unscientific to please any one.

But it is not after all, the names which most concern the farmer, although in order to be a rational one he must understand them. The substances themselves are what he is interested in, and their application in his business. He ought to understand the relative value of different manures and their adaptedness to particular soils or crops; the preparation, improvement and management of manures in order to secure their highest effect; the composition of soils and plants and the effects produced by the latter growing in the former, to exhaust them and render them unproductive; in fine he must know the whole relations of the vegetable, mineral and animal world. The farm should be regarded an out-door laboratory where every process is regulated by rule as strict as the chemist obeys in his. If we should stop to give instances to substantiate the value of this kind of knowledge, we should soon fill a volume, for there is no process in the whole art that would not bear us out. Therefore we need not do it. We are well aware of the prejudice which has heretofore existed against book farming; a prejudice which is rapidly disappearing and which was the child of ignorance.

It cannot be possible that agriculture alone of all the arts must stand aloof from the aids offered by science. All other industrial occupations owe their elevation and importance to it. And what may not farming be, when the farmer in the full realization of the dignity of his calling, becomes the thoroughly informed man he ought to be. And there is no sufficient reason why any man in this country should be ignorant of all the improvements that have been made in agriculture, and equally true is it, that knowing them, there is no reason why he should not put them in practice. We are a reading people. We mingle with each other. What one does, is seen and known by all. The distinction of classes is only nominal, and in all that pertains to the common good, all meet on common ground. The interchange of thoughts and views is free as the air we breathe. The means of acquiring knowledge are cheap and abundant, and in every man's power. I say again, there is no reason why any man should not be well informed in all that concerns his business. But before all are so, the barriers raised by prejudice and early training must be broken down, and

that patriarchal respect for old customs and old usages and old ways must be done away.

The education and elevation of the farmer is not a Utopian scheme, even for the present generation. And for the next we may expect men competent to fulfil their destiny as the foundation and support of this republic. England and Germany are in advance of us, but when we move it is with rapid strides. They have laid the foundation in their investigation and discovery of the laws of organic life, and we must build upon it. The practical farmer in this country has not been behind the man of science. The latter has but just begun to arouse himself to his duty, as the former is looking to him for counsel. Where they occupy the field together, what results may we not anticipate? It has, perhaps, been to the hindrance of improvement that the scientific men have not taken the lead, and have left practical men to guide themselves in the to them untrodden fields of science. It is that fact that has caused speculation to be substituted for true knowledge, and thus, although a large and extensive desire has been manifested by intelligent men to adopt new measures, yet from want of proper direction, their notions of what they want have often been so indefinite as to lead to no beneficial result. We would not be understood as depreciating the very laudable efforts made for improvement by our agriculturists. On the contrary, we are rather disposed to censure those men, who from their studies are capable of giving an intelligent direction to that spirit of enterprise which might at this time have effected vastly more than has been done. But neither can go alone. The theories of one and the facts of the other must eventually meet, and thus a firm superstructure may be raised.

A few years ago farming was regarded as little better than a menial service, and the farmer was looked upon as little elevated above the serf or the slave. It was forgotten that agriculture, the manufacturing and the commercial interests, were all inseparably connected in the prosperity of the state; or rather, in the words of another, "that the land and the owners, and the cultivators of the land, form the *primary essentials*, and the mercantile and manufacturing establishments, the accidental adjuncts of our state—and that the ruin of the solid walls and foundation of the stupendous fabric of the greatest nation upon earth, would involve in one common destruction its richest appendages and most orna-

mental decorations."* No country can—and this country especially cannot, foster too fondly its agricultural interests. It is now, and must continue to be our national wealth. And this is at the present time eminently the direction of public feeling. To whatever cause it may be attributed—whether to the wish to be free from the anxieties and cares and insecurity of commercial life—to the sense of the greater security of the landed interests—whether to these selfish considerations, or the return of a healthy state of moral feeling, urging the conviction of the holier and happier influence of rural pursuits upon themselves and their children—to whichsoever of these circumstances it is attributed, it is a gratifying fact that many wealthy and intelligent men are forsaking the large cities, and devoting themselves to agriculture. And to them much of the credit is due for the improvements that have already been made. What farther duties devolve upon them we shall have occasion to consider hereafter. We rejoice that they have begun to raise the farmer to his proper position in society.

But the education of the present generation of farmers we regard as of small importance compared with that of their children. Here is our great reliance. This subject is one which has of late been much discussed, and has arrested the attention of the executive committee of the New-York State Agricultural Society, and the officers of the common schools of that state. They have taken some action upon it, and have recommended the introduction of agricultural books into the district libraries, and that society has offered premiums for text books to be used in the schools; with what result is yet to be determined. But laudable as this movement is, we regard it with comparatively little anxiety. The mere *agricultural* education of the young is a matter of small moment in comparison with their *general* education. In our common schools, a large majority of the pupils are children of farmers. Three fourths of our whole population are employed in tilling the soil. Upon these in a great measure, depends the prosperity of our free institutions. In civil relations no class ranks higher, or can command more power. Our legislators are—or should be—largely chosen from among them, for theirs is the commanding interest. How important then, that they should be well instructed in all that concerns the citizen as well as the farmer. Education does not

* London Quarterly Review, March, 1844. Article—Agriculture.

necessarily unfit any one for the business of life, and we would see our youth growing up, reading—thinking—reasoning men. Make them such, and we make them intelligent farmers.

We do not intend here to go into the full consideration of the methods of education adapted to our farming population, nor of agricultural schools and colleges. This will afford ample material for a further article. As far as agricultural information is concerned, there is no want of sources from which to derive it. Periodicals devoted to this subject are numerous and increasing. Books have been written and published, both practical and scientific, and all at little expense. A new literature is fast going through the process of formation, and we may soon expect to see the farmer's library as well stored as that of the professional man. Then will agriculture be raised, as it should be, to the dignity of a profession, and its followers cease to be regarded as mere machines to toil and dig, forgetful of their higher nature.

II. Preparation for farming upon correct principles is an individual concern. Every man must do it for himself. But when we come to the application of these principles to practice, there is much that one or a few may do for the benefit of the whole. What a man knows, he knows for himself; but from what he does, thousands may learn to do the same. And in this country, whose inhabitants are celebrated for "having their eyes open," what is done by one is seen by all. And one of the best stimulants for a young, or even an old farmer—if free from prejudice in favor of the way his father did—to improvement in the management of his farm, is to visit those that are well conducted—to examine the manner in which they are managed—the implements, the stock, the fences, the buildings, and the whole condition of it. We were forcibly struck with the value of this, upon reading the fact that an English proprietor, in order to give his farmers an idea of the benefits of improved methods, had paid their expenses while travelling to visit a district where farming was conducted upon scientific principles. The effect was, that they improved from that time, by adopting the plans they had witnessed. But farms conducted upon such principles, are too rare in this country to be easily found; and if they were to receive the visits of all our farmers who need the example, we fear their enterprising proprietors would reproach us for the recommendation.

The neighborhood of our large cities and the borders of our

great thoroughfares are rapidly becoming occupied by a new class of agriculturists. Men of wealth who are retiring from business, and who are indisposed to settle down in inactivity, are purchasing small farms and turning their attention to the cultivation of the soil. These are the men to whom the country must look for example in this great field. Accustomed to the brick and mortar of the city, and often unacquainted with the simplest of the principles or processes of husbandry, they have all to learn. They can also bring intelligence and wealth to the business. Why may we not expect them to take a noble and decided stand in favor of modern improvements? At the same time, let us recommend them to be cautious and prudent, and have an eye to the general advancement of the art. Some cases have come under our notice where gentlemen of this class, no doubt with a laudable ambition to show large results, have bestowed an amount of labor and expense upon crops which would be ruinous to the common farmer. It makes no difference to them at what cost—but the only good we can see flowing from it, is the showing the capabilities of the soil when tasked to its utmost limit. But this is not what is wanted, unless it can be done with profit. It is not the effect produced by manuring with a compost of a large number of costly materials, which more than swallow up the proceeds of the crop—nor that of applying an immense quantity of manure to result in the same loss—these are not what the American farmer wants—but to learn how he may reap the greatest product at the least expense. Economical farming is the thing desired—to develop the whole resources of the individual farm in its soil well tilled—its yard manure—its marl—its muck—the waste of the house and the farm—all, in fine, that can add to its productiveness, and that with the least outlay.

There are also operations which are attended sometimes with considerable expense, which nevertheless repay largely in their effects, and add greatly to the capacities of the farm. They have been little practiced in this country, but in others have been followed by the very best results. And to some of these we would briefly call the attention of the class of whom we are now speaking. The first is *deep ploughing*.

As ploughing is generally practiced in this country the soil is very rarely loosened to a greater depth than six inches—perhaps

not often so deep. But there are benefits to be gained from deep ploughing when judiciously done. The effect of rain falling upon and passing through the soil is to wash down to too great a depth to be reached by the roots of plants those soluble substances which are their food. Not only the mineral parts of the soil, but the manures which are applied, are washed out and oftentimes accumulated in the subsoil in large quantities. These, if turned up and mixed with the soil, would add greatly to its fertility. The mere loosening the earth to the depth of ten or twelve inches will be very useful by allowing a greater extent of the roots of plants. At the same time, caution is necessary lest the subsoil contain substances which may be injurious to vegetation. In such cases the use of the subsoil plough should precede deep ploughing, to allow free access of the air to assist in the chemical changes necessary, and also to partially drain the soil by affording a free exit to superfluous moisture. This latter process has never yet been very extensively introduced into this country, and it is our belief that our agriculture has suffered much from the want of it. The surface soil has been tilled over and over, while the process of deterioration has been going on in the older sections, till its productiveness seemed almost lost. Deepening the soil would unquestionably vastly add to its powers, if it does not in a great measure restore them.

But these processes are far too little appreciated in this country. Indeed, the difference between them is not known by many, and when subsoil ploughing is spoken of, they suppose that it implies bringing the subsoil to the surface. But this is by no means the case, the process only consisting in tearing up the subsoil in the furrow which another plough has made, and leaving it to remain in this broken state below the next furrow turned upon it. The value which is attached to this in this country may be inferred from the fact that among all the numerous implements exhibited at the late fair of the New-York State Agricultural Society, and also at that of the American Institute, in the city of New-York, in October last, we searched in vain for a subsoil plough, although we heard numerous inquiries for them by persons wishing to see what they are. Wherever they have been used, although attended with extra cost, this has been more than repaid in immense produce. But this is not the only gain. The additional

ease of tilling the soil afterwards, is a consideration of no small importance in all cases, and especially in those heavy, cold lands with a retentive or impervious subsoil, which are much benefited by the operation.

Another process, which has not found its way into this country to any great extent, is thorough draining. The effects of this upon English farming have been most wonderful, and we know of nothing which now is exciting greater attention in that country. Since its introduction immense tracts of land which before were worse than unproductive have been reclaimed and reduced to tillage, and are now among the most fertile. Although attended with considerable expense, yet the money is not thrown away—for land which rented for two to five shillings the acre before draining, readily brings twenty, thirty, and even as high as forty shillings, after this is done. We might quote abundant facts in this connection were it necessary, or in the scope of this article. A writer in the Gardener's Chronicle states that "Draining in the best manner seldom costs more than £6 per acre, and can be often done effectually for half that sum," and that cold, wet lands which will not average sixteen bushels the acre, "when properly drained, with the same labor and manure, will average thirty bushels." Thorough draining is not so extensively necessary in this country as in England, yet it would be difficult probably to find a farm where it could not be employed to a greater or less extent with great advantage. The partial system of draining which is generally practiced is productive of very little permanent good.

The example of wealthy, independent farmers is necessary to the introduction of these improvements, and when they are once seen in their practical benefits, enough will be found to adopt them. Before they are generally received, men must be convinced that there is no risk nor danger of loss attending them. Once let them see that by the application of improved methods of farming they may in a very few years not only pay the interest, but actually receive both the whole cost in increased products, and they will no longer hesitate. In England, where most of the land is held under leases, the proprietor usually, either alone or in connection with the tenant, makes the improvements. But in many cases the tenant himself, where he holds on a long lease, makes them himself, anticipating with all certainty a large remuneration

in the increased fertility of the soil. In this country, where every man tills his own land, it seems an impossibility to convince many that all the improvements they put upon their land is so much added to its real value—not only its productive value from year to year, but its market value.

The limit of productiveness in the soil is not known—the extent to which its fertility may be increased. And the question is not, is this soil adapted to wheat, or something else, but whichever is most profitable to the grower must be compelled to grow upon any soil. This is true scientific farming, and when at the same time the greatest amount is raised at the least cost, we have all the demands of the art fulfilled.

III. The application of scientific principles to agriculture is the business of the practical farmer—the investigation and development of them to the chemist and naturalist. Why they have hitherto not directed their labors more to this end, is difficult to understand. One thing, however, is certain, that the labor and time employed would have been but poorly repaid. It cannot be expected that they should work without pay any more than it can be expected of the farmer. And when the latter is fully awake to the value of the aid to be derived from the former, it will be found that he is ready and competent to the business. It is not long since we received a communication from a practical farmer, setting forth the benefits of scientific knowledge in agriculture—giving a history of the progress of improvement abroad, and urging the raising a fund *to employ a chemist from Germany* to analyse soils; and also suggesting that Professor Johnston be invited to visit this country, in order that his opinion might be obtained with regard to the improvement of our agriculture. It is not wonderful that such should be the feelings of a man desirous of knowledge in his occupation, for almost all the books on the subject are written by Europeans, and almost all authorities quoted are of the same parentage. This, we do not believe, is altogether the result of a preference for foreign opinions, although we know that the idea is somewhat prevalent that they are better than our own. The science of agriculture is the same the world over, but its application to practice must vary with the climate, and, in a measure, with the habits and condition of a people, and other circumstances. As far as mere science is concerned then, both theirs and

ours is the same, but our farmers would find themselves greatly astray if they were to follow those systems out in their practice.

It is therefore the duty of the scientific men of this country to lay their hands to this enterprise, and to direct their efforts to the improvement of American agriculture. While they hold back, the farmer will wander but half enlightened. As we have said before, both must go together. The methods by which they are to advance the science of farming are too well understood to require any thing more than mere mention, at this time. The analysis of soils, and especially of the ashes of our various cultivated plants, must lay the foundation. The latter we regard as the most important, because of the impossibility of determining the value of the soil on a farm, by examination of one or even many specimens. If portions of the soil from different parts are mixed, the indications derived from analysis will of course not be definite with reference to any one part nor the whole farm, from the known varieties of soil which often occur in close proximity to each other. For the same reason the analysis of one specimen is not to be relied upon, in forming an opinion of what may be needed to improve the whole. The analysis of plants, determining their exact constituents, is calculated to lead to correct conclusions as to what is necessary to perfect their organization, and is attended, in the end, with vastly less labor.

The subject of manures, in respect to their relative value—the subject of adulterations—fixing the quantity to be applied, and the period to apply them—the relative value of different kinds of food for stock, and its applications to the rearing and fattening of animals and to the business of the dairy, and many other subjects of this kind demand the labor and investigation of the chemist. The vast field of vegetable and animal physiology, as yet scarcely entered upon, offers great inducements for research. The improvement of breeds of cattle suited to our various climates is a subject of great importance in this country at the present day. Indeed, the whole world of science in its application to various branches of husbandry, lies open to the scientific man, and the wants of this country call for his aid.

IV. The introduction of new articles of culture is a subject worthy of attention by the American farmer. He is not restricted by climate to the cultivation of a limited variety of products. Our

country embraces all climates and is suited to the plants of almost all zones. It is unnecessary here to enter into an examination of particular ones, but it is hoped that their importance will attract that attention hereafter which they deserve. It has already called forth some notice, but not so much as it ought. The culture of silk is exciting increased interest every year. The proceedings of the Silk Convention held in the city of New York, in the month of October last, displayed a most gratifying zeal in this pursuit. It is now demonstrated that this climate is favorable to the business, and may we not expect that the time is not far distant when the amount of imports from foreign countries will be very much diminished, if we cannot enter into the full faith that we shall ye become exporters of the article.

The cultivation of hemp is assuming at the present time no small share of importance, and under the new modes of preparation for use, bids fair to become of great consequence to the country. The olive—madder, and other articles which we have hitherto drawn from other nations, may be cultivated in this country with profit, and it is only necessary that the enterprise of our agriculturists should be awakened and directed to them. The following statement of the amount of some of these products imported to the United States from foreign countries, will show their cost to us, and what may be saved by growing them ourselves. In the year 1842 the value of imported silks, was $10,095,382; hemp, $1,119,559; olive oil, $138,247.

We have attempted briefly to show what may be done for American agriculture. That the subject has not been examined in all its bearings is true—indeed it were impossible in the span of a single artice. We hope however to have opportunities in future, in more practical papers, to set forth the subject more at large. That something must be done is felt by all. Our farmers are groaning under low prices—the new states are running a strong opposition with the old, and the only way for the latter to equalize themselves with the other, is to make use of all the improvements which are in their power.

Again—in the old states, many are adopting, and many more will adopt, new methods, and the rest must be left behind. They cannot compete with them whilst they stick to old practices, any more than they could with old fashioned implements. Thus two

laws govern the two cases—the best implements and the best methods will insure success—and those who adhere to old implements and old methods must do it at *their own loss.*

EDUCATION OF THE AMERICAN FARMER.

There is nothing remarkably strange or remarkably wrong in the disposition of Americans to seek after new things, or to be dissatisfied with old. Many look upon a thing with which they have become familiar, as they look upon a coat which they have worn for a time, and consider that on this account it is really worn out and must be changed.

In some matters this disposition to change is of little or no consequence, and is not likely to be followed by injurious effects. When we come, however, to other matters, as our institutions, this disposition to change is to be looked upon with concern and apprehension, lest on the one hand, we should injure establishments which are doing all that is possible, and doing it well, or on the other hand, attempt to substitute in their places those which are inferior in point of utility, and more expensive in their arrangements. In these cases some higher principle must actuate or control our determination or judgments than those which govern us when we change our hats or our garments. Our inquiry in such cases, what is the fashion? ought certainly to be made with a very jealous eye.

If, for instance, the fashionable or popular cry should be for some great change in our educational institutions—institutions which have produced great and good men, as our statesmen, our judges, our leaders in trying times; men honored for attainments at home and abroad, whose discoveries in science and the arts have benefited the nation—we should listen to it with great caution and distrust. By these remarks we do not wish to be understood that we believe our institutions may not sometimes be improved by introducing changes both into their organization and in their courses of instruction, but we mean to be understood that an old thing is not to be abandoned simply because it is old, nor a new to be introduced because it is in accordance with the popular

cry, or the fashion of the times. If, however, they have ceased to be useful; if they no longer answer the purposes for which they were designed, let them be abandoned; or if they are no longer adapted to our circumstances, and cannot fill the place they once did, then let them be replaced by others, and by those which are better.

These remarks are made in consequence of the opinions which have been freely expressed in some quarters, particularly in agricultural meetings, that our colleges and higher schools of learning are not adapted to fulfil the wants of the farmer; or in other words, that he needs an institution of a different character, and founded upon a different plan; for as they are not to be lawyers or clergymen or physicians, but are destined for a different sphere, so their education should be adapted to fit them to move in that sphere, or to be more definite, their education should be agricultural. This view of the subject is very plausible, and it is not strange that many should fall in with it, and believe that it is the very thing which will do for them.

But let us see how much real soundness there is in the position. In the first place, if this view of the subject is the right view, then it would apply to all persons who design to be educated: and the lawyer must have his, the physician his institution, and so on. But again, in order to get at the merits of the question, how the farmer shall be educated, we must understand first what the collegiate course of study is designed for. We answer, they are designed to develop the mind. All the collegiate exercises and studies have no other end than the development of the intellectual powers; the student is trained by a systematic course, which though it is in mathematics, or languages, yet it has no reference at all, *necessarily* to his future business; it looks not to the question whether he is to become a clergyman, lawyer or physician, farmer or watchmaker. The whole course of instruction is to be considered as preparatory; it is only to lay a foundation; it is disciplinary. In this disciplinary course, however, he acquires something more, it is true, than the mere rudiments of knowledge; much of it is eminently practical, but still the course is designed for discipline and for development of the intellect. For securing this object, it proceeds in regular gradations from the less to the more difficult and abstruse studies; it is intended to lead the

mind step to step, advancing upward, as the intellect acquires power by previous exercises. If these are not the main objects of study in early life, we know not what the objects are.

If, then, we are right in this position, what follows when we inquire what institutions are required for the education of farmers' sons? Shall institutions be established which have no regard to the development of the mental powers—institutions which shall take the narrow view that of simply fitting the sons of farmers how to plough; to sow and to reap, or carry their acquirements a little farther, how to analyse soils, to distinguish rocks or the different objects in nature. This is well and right and important, so far as it goes, but it is essentially defective; and in order that an institution for farmers' sons should be adequate to meet their wants and necessities, it would still have to embrace in its course of instruction that which is disciplinary—that which shall develop the intellectual powers. Taking this view of the subject then, we conceive that so far as institutions are concerned enough already exist to meet the wants and necessities of community. This is the view not only as it regards the attaining the full objects of education, but it is the true one so far as economy is concerned. A new institution must have its full board of instructors, its buildings, apparatus, and its endowments; whereas the institutions already established have all these requirements supplied.

However, that the old and useful institutions may be more useful to the agriculturist, let one of their present officers, a professor of chemistry, give a course of lectures on agricultural chemistry, which shall embrace the modes of analysis of soils and of the organic substances. Or to be still more useful, let the ordinary course be varied somewhat so as to give to a class of pupils who intend to pursue agriculture, personal instruction; or superintend a particular course of study which is deemed most suitable and best adapted to meet the particular inquiries of the farmer. To be brief, however, on this subject we need only say, that there is no doubt in our minds but the institutions already established are either in their present organization and course of study fitted to supply all the wants of farmers' sons, or they may with trifling alteration in their course of study be adapted to meet them. We intend here however, to speak only of the capabilities of our present institutions, not of the course of education which is particularly adapted

to the farmer. We, however, in this matter, should take the view that it is not simply the farmer who is to be educated; it is the man and citizen, and any plan or course of education which leaves out of view this sphere must be essentially defective, must be unsound and tend to foster a narrow and confined view which belongs only to place and business. The principles on which our institutions are founded are not worn out; though they are ancient, they are founded on those which will not essentially change; they are not, it is true, inflexible and unyielding in their adaptations. Like communities and like individuals, the progress of mind must carry them along, the discoveries in science which they themselves have been instrumental in making, must add from time to time to the course of study. They must then enlarge the field of their operations; they must adjust themselves to the conditions of society which they have actually brought about. But we do not believe for all this, that for every wind which blows, they are to change the course of their educational voyage which they are conducting, that they are to steer for another port, though it may be nearer than the one for which they have set their sails and their compass.

But still it is a happy feature in our institutions that while they move forward on the sea of human affairs, that while on this or that side the breeze may spring up: still they can gently give to its impulse, by swerving from an upright position accommodating themselves to the varying forces, and even if need be, outride the storms which rise by stiffly adhering to the principles upon which they are founded, and keeping clearly in view the chart which experience and observation has constructed for their guidance.

THE CLAIMS OF AGRICULTURE UPON GOVERNMENT.

The whole number of persons in the state of New-York, engaged in agricultural employments, according to the last census, is 455,954; the whole number devoted to commerce is 28,468; the whole number employed in manufactures is 173,193. It will then be seen from this short statement, that the agricultural is, numerically speaking, the great interest in this state; and the

same holds true of all the other states in the Union, with the exception of Massachusetts, Rhode-Island and Pennsylvania.

The fact just stated, that the pursuit of agriculture is the one in which the great mass of our population are engaged, is sufficient to show that no other interest can have a greater claim upon the attention of government; and looking to the past action of the legislature, in the encouragement given to the formation of agricultural societies, we think there is evidence to believe that this conviction is a general one. Certainly we are not aware that any complaint has been made in any quarter against this use of the funds of the state. No formal argument, therefore, seems necessary to prove that government should do something for agriculture; the obligation has been already acknowledged, and to a certain extent acted upon by our own and other states. It may, in fact, be looked upon as an established axiom in political science, that *all* the leading interests of the nation—agricultural, commercial, manufacturing, have claims upon the legislature,—claims which cannot be in any case neglected without producing ultimate injury to all. In all these departments of human labor there are some things which can be done only through the collective energy and influence of the state; the resources of no single person, of no individual corporation, are adequate to their accomplishment. And as government exists not for its own sake, but for the benefit of the governed, the inference seems an obvious one, that where there are benefits which the governed cannot individually secure, and which can be attained for these by government, they are entitled to count upon its aid.

The equitable adjustment of these particular claims is undoubtedly attended with no small difficulty; how, in other words, shall government lend its aid to any one of the three great interests before mentioned, without exciting the just jealousy of the others? We are disposed to look upon this as one of the most important problems in political science; it is one which has long been discussed, both in Britain and in our own country, but it has not yet been satisfactorily resolved. Some, indeed, very confidently affirm, that the true answer to it will be found in these two words—*free trade*; but while this theory is "very fair to look upon," it is still nothing but a theory, for not one of the great family of nations has ventured to adopt it.

However, it would be beside our purpose to enter into any speculations on this point; one of the principles of our national policy always has been, and is now, protection;—equitable, indeed, even handed, yet decided protection to all those great interests in which our citizens are engaged—to the merchant, the mechanic, the farmer;—all have tasted in a greater or less degree of the pleasant fruit of governmental aid. The question which we propose to discuss in this article is the practical one, what *can* the government (federal and state) do for the farmer? keeping of course within those limits respecting which there is no dispute—in what way can the most effectual aid be given to that particular pursuit, in which the vast mass of our population are employed? and which is, in truth, the basis and support of every other—agriculture.

Now, in the discussion of this question it may be observed, that there are various ways in which the legislature may lend its aid to the farmer, apparently to his great benefit, while in the ultimate result, if he is not absolutely injured by it, he at least derives no substantial good. For example, bounties may be given to encourage the production of certain articles, which are quite unsuited to the particular localities in which they are attempted to be raised. Some years since, the state of Maine expended (annually) a large sum in this way, with a view to induce her own farmers to cultivate wheat. And so the state of New-York *might* make an annual appropriation for the purpose of introducing the culture of tobacco; now it is not difficult to show that in such cases the farmer is rather injured than benefited, because his energies are misdirected; he is put upon the cultivation of something for which his soil or his climate may be altogether unsuited, and which the farmer of some other state will raise for him at a far less cost. We do not mean by these remarks to intimate that bounties should never be offered, but there is danger of carrying out the thing to an unwarrantable length,—of overlooking the great physical fact of the diversity of soil, climate, &c., and that no single locality, however highly favored, can produce every thing. To attempt every thing is to gain nothing. In our judgment, the only object of a bounty should be, not to *force* the cultivation of some thing new, but effectually to test the capabilities of the state; and to do this it certainly is not necessary to keep up a *system* of bounties.

Another illustration of well-intended but ill-judged legislation for the benefit of the agriculturist, may be drawn from the long established policy of Great Britain. Her landed interest has long been the object of her special regard and special legislation; she has steadily aimed to secure to her own farmers all the advantages of her own markets, to shut out all possible competition. But with the progressive development of the resources, and the extension of the commerce of that great empire, other interests have been created, and though it cannot be said that they have been wholly uncared for, yet the landed has been the grand interest. The result of this special legislation for the farmer's good is, that those interests have been rendered antagonists striving for the mastery, whose natural state is one of mutual co-operation for a common good. It has been well observed by a writer in the London Quarterly Review, "that the agricultural and commercial portions of our population are embarked in the same bottom, forming the complex cargo of the great galleon of the state, in which they must sink or swim together."

We are free to confess that we are not at all desirous to see any such legislation in behalf of the American farmer. So long as our tariff is based upon the principle of protection, he unquestionably should have his share of it. But we regard this as a matter of little moment, because our agriculturists are as sure of our home market without a protective tariff as with one.

The great thing, we apprehend, which the farmer needs, is to know how to make his land in the highest degree productive, at the least possible expense. We look upon this as the grand problem in agricultural science; and it is one which cannot be satisfactorily resolved without the efficient and judicious interposition of the legislature. And when we consider how intimately the solution of this problem is connected, not only with the primary profit of the farmer, but the physical happiness of all classes of the community, no man will, surely, venture to say that this interposition should be denied. It is a fact which may well seem strange to us, that while the mechanic, the manufacturer, the man of commerce, by applying the discoveries of modern science to their respective pursuits, have increased their wealth to an extent which arithmetic can hardly compute, the farmer, until within a very short period, has remained quite unconscious that the same

science might be applied with the same prospect of success to his employment—the most ancient and the most important of all human arts. But the revelations dimly seen, or rather prophetically guessed at by Lavoisier, and since his day fully unfolded by Davy, Johnson, Liebig, and others, establish beyond all doubt the existence of a most intimate relation between chemistry and all the occupations of the cultivator of the soil. Indeed, the discoveries of agricultural chemistry have rushed upon us so rapidly, as hardly to give us time to form a just estimate of their individual magnitude and importance; and while it would be absurd to say that they open to the farmer a future of indefinite progression in the productiveness and the productions of the soil, this much may be affirmed, that they prove the impossibility of *now* fixing their limits.

In an admirable article on agriculture, in a recent number of the London Quarterly Review, it is stated, that "between 1801 and 1841, the population of the British empire increased from 16,300,000, to 26,800,000; and these increasing numbers have been sustained with food almost entirely by the augmented productions of our own improving agriculture. By extensive enclosures, draining, &c., an amount of new and efficient forces have been called into action among the more energetic and intelligent part of the cultivators of the soil, especially in the northern and eastern portions of the island, which has been very nearly adequate to meet, from our home supplies, the increased demand for food arising from the addition of 10,000,000 to the population of the empire in the first forty years of this steam-rate century." We introduce this passage simply to show how the productiveness of a country may be increased—even one which has for many centuries been under cultivation. The results of particular instances of improvement, as given in the article already quoted from, are truly astonishing; and what is worthy of especial remark is the fact that the most surprising of these results should be placed to the credit of agricultural chemistry.

Now, how shall the problem of greatest and most profitable productiveness, at least expense, be resolved? In this important work, there is doubtless much which the American farmer must do for himself, but at the same time he needs, and must have, the aid of the state. For,

1. The first step towards improvement is a conviction that we have not yet reached perfection. But it is well known that convictions of this sort are not very easily awakened in the minds of persons moving constantly in the same limited circle, comparing themselves with none but their immediate neighbors. Such men are commonly prepossessed in a degree commensurate with their ignorance, that no improvement can be made. How strong and widely extended, for example, has been the prejudice among our agricultural population, against "book farmers?" This illiberal sentiment still exists, though we believe it is beginning to give way. What now can be expected of such men in reference to what is, not merely a practical art, but a science of the highest order, requiring a combination of various subordinate sciences in order to consummate its perfection. It is an established fact that the sciences of chemistry, of animal and vegetable physiology, of mechanics, form the foundation both of the theory and practice of that most important art, whose object is to obtain supplies of food, by co-operating with those laws which regulate the growth and multiplication of the animal and vegetable productions of the earth. Agriculture, says Liebig, is both an art and a science; its scientific basis embraces a knowledge of all conditions of vegetable life, the origin of the elements of plants, and the sources whence they derive their nourishment. Now looking to the vast mass of our agricultural population, in their present character and modes of thinking, it is vain to expect that they will, individually, make those experiments without which there can be no useful discovery.

2. But even if they had the disposition, the great majority of our farmers have not the means of making the requisite experiments fully to test the virtues of various soils and manures. The farmer's whole capital—we speak of the class—is invested in his land and the usual means of its cultivation; his farm probably is not without some incumbrance upon it; he can, therefore, spare neither his land nor his time, for experiments which may turn out well, and may subject him to loss.

3. Neither can the gentleman-farmer—to use a term which has become somewhat common—be depended upon for the determination of the great question before mentioned. We of course must be understood as speaking of them generally. There are no doubt many exceptions to the remark just made; there are men possess-

ing the means, the disposition, and the intelligence necessary for the successful prosecution of this work. But without enlarging on this topic, or meaning to intimate that the labors of this class of agriculturists have been wholly useless, we have only to refer, in proof of our assertion, to the pages of our agricultural papers. These record a vast multitude of experiments, and they sometimes announce stupendous results—29 to 70 bushels of wheat to the acre—but they are for the most part quite silent as to the expense of production. We have read of composts containing from twenty to thirty different ingredients; now, not to speak of the costliness of such a composition for enriching the soil, a circumstance which puts it quite out of the reach of the mass of our farmers, the experiment in a scientific point of view is worthless, because in such a combination of agencies it is impossible to determine which of them are hurtful or useless, and which are beneficial.

The work, therefore, if ever done effectually, must be undertaken by the state; she has ample resources; she will, of necessity, call science to her aid; and she will aim to elevate and benefit the agricultural interest, not merely in a particular locality, but throughout her entire extent. But the practical question arises, in what way shall the state lend its aid? In reply to this inquiry, we beg to observe,

1. That the general government owes a duty to agriculture—to American agriculture, and this duty is all the more urgent inasmuch as it can be fully discharged without withdrawing one dollar from the national exchequer. The pecuniary means of performing the great work to which we have adverted, have been furnished through the singular generosity of a foreigner. We of course refer to the Smithsonian bequest. It certainly must be regarded as disgraceful to our government, that scarcely a single step has been taken towards the fulfilment of the benevolent design of the testator, though several years have elapsed since the money was received. We do not mean to attempt an outline of the entire system of instruction which should be pursued in the Smithsonian college: all that we mean to say is, that the diffusion of useful knowledge in reference to that branch of human industry, which is the basis of all others, and in which two-thirds of the whole population of the United States are engaged, should be one of the prominent objects of its erection. By the devotion of one-

fifth of the sum in the hands of government to this object, the interests of agriculture throughout the entire Union might be vastly benefited; the erection of the institution near the seat of government would greatly help to diffuse its blessings far and near.

As we have already intimated, we would not wish the Smithsonian college to be a mere agricultural school; there are other equally important branches of knowledge, which should not and need not be overlooked; but we regard this subject as one which eminently deserves the early and earnest attention of the friends of agriculture in all the states. It is high time that the money be used for the noble purposes for which it was given.

2. We believe that a better use might be made of the sum which has been placed by the legislature of our own state at the disposal of the State Agricultural Society. The existing law will soon expire by its own limitation, and in any future act, we deem it of great importance that those who may have the management of the fund, should be directed to reduce the number and increase the amount of their premiums. In this way, we believe that much good will be done, and at least expense to the state; so far, at least, as respects experimental agriculture, if we may be allowed to coin a phrase. Many a farmer might be tempted to undertake the raising of some new production by the offer of a premium of one hundred or five hundred dollars, who would not venture on the experiment for five or twenty dollars. Take, for example, the article of hemp; the question whether it can be profitably cultivated in our state, might by the offer of a high premium be settled in a single year, or in two years at most.

3. The establishment of a permanent department or a Board of Agriculture, is a subject well worthy of serious consideration. The fact that the state society has for some years been employed as the agent of the state, seems to us to be a virtual acknowledgement of the want of some such department of government. Why then, shall we not have one responsible like all the other branches of the government to the legislature and the people? The interest to be watched over is a commanding one; it, more than any other, affects the general welfare. It deserves a department, and we fondly hope that the day is not far distant when we shall have one.

4. The promotion of agricultural science is another duty which

the legislature owes to our farming population. This branch of our subject is amply large enough to merit a separate discussion. We have neither the room nor the time to enter into it with the fulness which it deserves, but we hope to be able to do so in some future number. The numerous and urgent proposals to establish agricultural schools, would seem to indicate a deep conviction in the public mind of the importance of the object itself; but how can it be best attained is a question to which different answers are given. An agricultural college, and the introduction of the study into our common schools, have been suggested. In regard to the first of these projects, we can only say at present, that the establishment of a college where the young farmer may at a small expense obtain the *whole* education which he needs to fit him for the duties of active life might be useful; but to found a *mere* agricultural school, in our judgment, would be a very unwise scheme. We entertain the same opinion in regard to the other suggestion, viz., the introduction of the study of agriculture into our common schools. If these schools were what they should be—if they were conducted by men who made teaching their exclusive business, the proposal might not be objected to; but looking at our common schools as they now are and are likely to remain for years to come, notwithstanding all the efforts to elevate, we cannot but deem the plan above mentioned as worse than foolish, for the result can be nothing else than the imparting of that "little knowledge" which is always "a dangerous thing." No. Let the study of scientific agriculture be introduced into our *academies*, and some good may be expected to be done. But we shall not pursue the subject further, as we hope to recur to it again in some future number.

SOUR SOILS.

It is highly important that, whilst facts are examined and carefully treasured up by the agriculturist, errors should also be searched out and guarded against; and this not less in practice than in theory. All the processes of agriculture are based upon theory of some kind. No farmer works by guess. He has his reasons for all he does, and can least of all, be induced to try anything new, unless there are reasons for it, and such

reasons as strike his mind as good and sufficient. Yet it is not to be denied that for many things he has only the show of reason, whilst in fact there is none at all. We will not say this is the case in regard to the subject placed at the head of this article, although we believe there exists no such thing as a sour soil. We offer no apology for differing from the farmer or the man of science in this respect, though both of them may be implicated in what we consider an error. We are well aware of the almost universal belief in it, arising, as we apprehend, in the practical man, from observing the benefit often arising from the application of alkalies and alkaline earths to the soil. The little knowledge which almost every one possesses of chemistry teaches him that when an acid and an alkali unite they form a *salt*—a compound generally of a mild and inactive kind compared with the substances which go to form it, and therefore it is thought, that when that class of substances is applied to soils which they call *sour*, an amelioration is produced by their uniting with the peculiar acid which exists there. But does the benefit result from their neutralizing a free acid which was injurious to vegetation? Let us examine it a moment.

What acid or acids are found by actual analysis, in a free state, in the soil? and which are prejudicial to vegetation, or which favor the growth of certain plants? It cannot be carbonic, for this, every one knows, is an essential part of the food of plants, and in the quantity in which it is commonly found, instead of being prejudicial, is an actual source of life and vigor. Examine the analysis of soils given by the most correct analysts. We find, it is true, that *inorganic* acids, (sulphuric, phosphoric and muriatic) are present in variable quantities in almost all soils. But we find also the alkalies, (potash, soda, lime and magnesia) and the oxides of iron and manganese as invariably present. True, we are not told in so many words, that they are combined with the acids, but it cannot be supposed that these substances should exist uncombined by the side of each other, in circumstances the most favorable for union. The moment they come in contact they unite and form salts, and in this form they are found. The analysis of a large number of soils from various parts of the state of New-York, during the last two years, confirm these views.

Are the *organic* acids found in the soil? It is granted on all hands that these are formed by the living and growing plant, and

depend upon the plant in which they are formed for their peculiar character. The oxalic acid of the sorrel, tartaric of the grape, citric of the lemon, and malic of the apple, and a host of others, may be formed by those plants growing in the same soil. Liebig says, "We have no reason to believe that a plant in a condition of free and unimpeded growth produces more of its peculiar acids than it requires for its own existence;" and he also says, that all of them "are in combination with bases."

During the process of germination a seed gives off acetic acid to the soil. But it does not remain there uncombined. If seeds are caused to germinate in powdered chalk or carbonate of lime, after a time *acetate of lime* may be washed out from the chalk, (Braconnet). And it is possible that the acid is sent out for this very purpose, to dissolve the lime and return with it into the circulation of the plant. At all events, it is always found in the soil combined with lime.

Oxalic acid is not known to exist in the soil or in the water which reaches the roots of plants So says Johnston ; and yet the production of sorrel, which abounds in this acid, is supposed by many to depend upon the sourness of the soil. But observation proves that if this is the case, lime, the ordinarily recommended remedy, will not so neutralize the acid as to prevent its growth, even when applied in large quantities. Thus, Mr. N. Darling of New-Haven, Conn., mentions having seen it growing near an old limekiln, luxuriantly, through a considerable thickness of lime. In the Cultivator for August, 1844, it is stated that Doct. Beekman, of Kinderhook, "had several loads of good lime spread on some land which was much infested with this plant. It was spread in the central part of the field very thick. After a lapse of two years, *no effect whatever* has been discoverable, either for or against the sorrel." It is but just to state here that numerous instances are mentioned of this plant being eradicated where lime was used. In the Cultivator for July, 1844, will be found a letter from J. J. Thomas, containing some curious facts in this connection. One is, that this weed disappeared from the land of Mr. Dell, after the use of lime. Is it not, to say the least, probable, that in all such cases a course of active tillage has done more than the lime ? But oxalic acid has never been found in the soil.

Some physiologists have attributed to the roots of plants not

only the power of absorbing food, but also of throwing off those matters which are taken up with the food and are not necessary for the growth or sustenance of the plant. Amongst the experiments instituted to determine this point, we find but one in which there is any evidence of an acid being excreted, and in this case it was united with a base. When the ground upon which the poppy had been grown was washed, a considerable quantity of *acetate* of lime was found.

But if free acids exist in soils they must be dissolved in the water which passes through, and will then appear in springs and wells, which we believe is never the case, although these waters always contain some salts. There is an apparent exception to this, but it is only apparent, in the case of carbonic and sulphuric acids as they exist in some springs and as they are produced beneath some soils in overwhelming quantities, so as to destroy all vegetable life. The presence of these acids depends upon some local cause for which there is no remedy.

Nothing has been said thus far of humic acid, which is known to abound in soils chiefly composed of vegetable matter, because this acid is utterly insoluble, and can therefore have no injurious effect upon vegetation. We are only considering such free acids as are prejudicial, and which of course must be soluble. It cannot be assumed that soils abounding in this acid are *from this cause* unproductive. They are so, not because they contain the acid, for it is generally admitted to be, under proper circumstances, an abundant source of nourishment to plants, but because the acid is insoluble, and cannot in this state be conveyed into the mouths of plants.

But after all, the question must be decided by analysis. It cannot be reasoned thus—because such a plant grows upon a soil, that soil is sour. The only evidence of its being sour is the actual finding an acid in it, and if one is there it can certainly be found. Besides, this question cannot be decided from the effect of alkalies, and till some acid is found in the soil, the cause of the benefit following their use, must be looked for in something else than their neutralizing power.

MANURES.

PART I.

THE RELATIONS OF ORGANIC TO INORGANIC MATTER.

MANURES are the food of plants. This is a fact which has been well understood through all the ages of agriculture, so far as the mere circumstance of applying them to the soil in order to secure a reasonable crop; but the *how they operated* to bring this about, or *why they were applied at all*, have been points not so well comprehended. That plants are beings of a delicate and complicated organization seems to have been long known, but this knowledge was of a general kind and led to no practical good. It has been left to the science of the present day to unlock this storehouse of exhaustless knowledge, and to astonish even the wise men of the nineteenth century with the wonderful developments that are almost daily made of the relations of organic and inorganic matter. A seed falls into the ground, and, watered with the genial showers of spring, soon sends up a tender shoot. It reaches upward—expands—throws out its branches and leaves to the light and air, and its roots reach downwards and pierce into the soil. Year after year it grows and spreads till it becomes a tall oak or the gigantic pine. It opens its blossoms and for a few days they rejoice in the glad sunshine and then fade and fall. Next succeeds the fruit—the seed—that strange product which is for the sustenance of the animal world. Whence have the materials been derived, which have served to build up the frame of the plant and perfect its fruit? Have they all come from the soil in which it grew, or from the atmosphere? We prepare the soil and manure it, and sow it with wheat. Does the crop depend upon the soil, the air, or the manure, for sustenance?

In the early part of the seventeenth century, Van Helmont advanced the theory that water was capable of supplying to plants all they need to perfect their growth, and thought he had demonstrated the truth of his theory by experiment. In the following century, Jethro Tull maintained that plants only required earthy particles for their nourishment, and that it was only necessary to pulverise the soil to secure an abundant crop. He supposed that

the only use of air and water is to aid in reducing the soil to the state of extreme division. Others have said that the vegetable matter in the soil was the great source of fertility, and till the light of analytical science was thrown upon the subject, every thing relating to it was vague and uncertain. It may now be considered as settled that plants are dependent upon the earth, the air, and water, for sustenance, and that deprived of either they cease to exist. The earth furnishes the mineral ingredients without which the plant could no more flourish than without those it derives from water and the atmosphere.

But in order to obtain a full comprehension of the action of manures and their individual value, it is necessary to take a more particular view of the relation which plants sustain to the earth on which they grow. That physician would be deservedly exposed to ridicule, who, ignorant of nature and character of disease and of the operation of medicines, should attempt to cure his patient by administering a potion consisting of numerous ingredients, hoping some one in the compound might reach the case. So ought the farmer to be placed by his side, who remains ignorant of the nature of soils and plants, and the action of manures, and applies a *fertilizer*, as he terms it, composed in a similar manner, in the expectation that his crop will have the sagacity to select what it needs and reject what it does not need. Such is not rational, neither is it economical farming. The object of the farmer ought to be to get the greatest yield from the least outlay—to apply those manures which will supply the wants of the crop, and at the same time render the soil permanently productive. We say this cannot be done without knowledge, and that, not a general knowledge that manures must be applied, but a particular and minute understanding of what constitutes a fertile soil, and what plants need to develop their powers in the greatest perfection. A full investigation of these subjects would far exceed the bounds of an article or even a series of articles in this Journal. The reader is referred to the various standard works on agriculture, for a full discussion of these points, and particularly to the lectures of Prof. Johnston, which is in our estimation the best work of the kind yet printed. In the meantime let us proceed as far as our limits will allow, and as essentially introductory to the consideration of individual manures, to examine the relations of plants to the soil.

When we look around upon the old settled and long cultivated portions of this country, and reflect upon what they were in the days of our fathers, we cannot but notice an alarming change. The soil has experienced a wonderful degeneration—it has lost its fertility. It has been tilled—it has been manured—it has been watered with the rains and dews of heaven, and with the sweat of toil, but its productiveness is gone—or as the owner says, it is *worn out*. But the land does not wear out. Some radical change has taken place which unfits it for the production of the crops it once bore, or any other. Here luxuriant crops of wheat once grew, there tobacco and there cotton were raised in abundance, but now the impoverished soil refuses a return. And what is the cause? This we will attempt briefly to elucidate.

When a portion of any plant is burned, the greater part disappears; a small portion of ash only being left. The quantity left by some plants is greater than that left by others, and the different parts of the same plant leave unequal quantities, and in all cases the residue is small when compared with the bulk of the plant. This will be evident from the following table:

Quantity of ash in 100 *lbs. of*

Wheat, ...	1.18 lbs.	Potatoe, ...	2.65 lbs.
" Straw, ...	3.51 "	" leaf, ...	4.79 "
Rye, ...	1.04 "	Turnip, ...	7.05 "
" Straw, ...	2.79 "	" leaf, ...	2.96 "
Oats, ...	2.58 "	Hay, ...	9.00 "
" Straw, ...	5.74 "	Red Clover, ...	7,70 "
Barley, ...	2.35 "	Parsnip, ...	14.34 "
" Straw, ...	5.24 "	" leaf, ...	15.76 "
Beans, ...	2.14 "	Elm wood, ...	1.88 "
" Straw, ...	3.12 "	" leaf, ...	11.80 "
Peas, ...	2.46 "	Oak wood, ...	0.21 "
" Straw, ...	4.97 "	" leaf, ...	4.50 "

The above tables are quoted to show the quantities of ash left after burning different plants, that the quantity is always very small, varying from one to fifteen per cent, and that different parts of the same plant give different quantities. The constituents of this ash are substances with the most of which every one is familiar. They are potash, soda, lime, magnesia, alumina, silica,

iron, manganese, chlorine, iodine, sulphur and phosphorus. These do not exist in the plant in their simple form, but variously combined with each other and with another class of substances to be mentioned hereafter. Till a very recent date they were regarded as not essential to the vegetable structure, being considered as being only accidentally present, from the fact of the plant growing in the earth. They are now however, regarded as not only important, but essential in the economy of vegetation, and it is the opinion of Liebig, that the presence of these substances exercises the whole control in perfecting the plant. If they were not necessary to the healthy growth of the plant, or were only accidentally present, we should expect that sometimes one would be found in plants of the same species, and sometimes another in greater proportion than at other times, or that plants of whatever kind growing in the same soil would contain the same quantities. But this is not the case. The variation is very slight in plants of the same kind, and those proportions may be considered as uniform. Nor do plants of different species, nor even those of different varieties of the same species, growing in the same soil, contain the same quantities. In the tables quoted above, a remarkable difference appears in the quantity of ash left by various plants, and the difference is as remarkable in the constituents of this ash. Thus, the straw of wheat gives more than three per cent of ash, in which the principal mineral ingredients are as in the following table compared with those of oats, yielding nearly six per cent, and beans more than three per cent. The quantity is what is found in 1,000 lbs. of straw.

	Wheat, lbs.	Oats, lbs.	Bean, lbs.
Potash, ...	0.20	8.70	16.56
Soda, ...	0.29	0.01	0.50
Lime, ...	2.50	1.52	6.20
Magnesia,..........	0.32	0.22	2.09
Sulphuric acid, ...	0.37	0.79	0.34
Phosphoric acid, ...	1.70	0.12	2.26
Silica,.............	28.70	45.88	2.20

A remarkable difference will be observed in the proportions of these substances in the different straws, and especially in the potash and silica. While the wheat straw contains potash 0.20,

and silica 28.70 lbs., the bean contains potash 16.56, and silica 2.20 lbs. in 1,000.

Healthy and perfect plants of the same kind, will always be found to contain the same number of these substances, and in the same or very near the same proportions. This constancy of composition, whether the plants are grown upon the same or different soils, is indisputable evidence that these substances are indispensable.

These portions of the vegetable structure are all derived from the earth, and a fertile soil always contains them. Not always, it is true, in the same proportions, but they must be there in some quantity, or it is unproductive. The amount of some one may be very small in comparison with the mass of soil, and yet in connection with others give it a character of high fertility, as every farmer has seen in the application of a minute quantity of gypsum to a field of red clover.

It will now be readily understood, to what this *wearing out*, or degeneration of the soil is attributable. In successive crops these substances are taken from the soil, and have not been restored in equal quantity in the manures that have been applied. The grain—hay—milk—butter—cheese—beef—wool, &c., have been taken to the market, and all that was contained in them of a mineral nature, was so much robbed from the soil. The process of deterioration may not have been apparent, for originally the supply was large. But such a drain kept up for years has had the effect of impoverishing the soil and leaving it at last, in a measure at least, unproductive. The amount taken off in any one year was small, but continued for a number of years makes a large quantity, and if the whole has not been restored in the shape of manures containing the very substances carried away, the land must eventually cease to be productive. At the same time another cause has been operating to bring about the same result. By the processes of cultivation some of these materials, which formerly existed in the earth in an insoluble state, are rendered soluble. They are taken up by the rain which falls, and carried down with it in its passage to the subsoil. In this way lime is often entirely exhausted from a soil.

It will be understood from what has been said, that all crops do not exhaust the soil of the same substances in the same proportion.

From this cause land which has ceased to be productive of one plant may yet be well calculated for another. And this has given rise to rotation in crops, now so extensively practised.

Another cause of unproductiveness in a soil may be merely mentioned here, and that is the presence of noxious substances. But this will be referred to more at length in another place.

All this might have been prevented and may be remedied. It is possible not only to restore a soil to a former degree of fertility, but the limit of its productiveness is not known. Besides, we know not the effect which a continued cultivation of wheat, for instance, on a highly improved soil may have upon the qualities of that grain. We know indeed, that all our cultivated plants have been produced from a naturally inferior stalk, and that those grown upon a poor soil are inferior to those grown upon a rich one, and that cultivation has been the means of making them what they are. Have they reached the limit of improvement? is a question it is hoped will not be answered till proper efforts have been made to answer—*no*. We believe not, and we also believe that as long as the soil is continued in a condition of progressive improvement, so long we shall find a corresponding improvement in not only the quantity but the quality of all cultivated plants.

But the relations of organic to inorganic matter may be traced yet farther. The vegetable world is the food of the animal world; the connecting link between the highest and the lowest orders of creation. The plant or its seed is eaten, and, behold, bone is made—muscle—fat—milk, and all the varied products of animal life. Whence all these? It will hardly be believed by those who read it now for the first time, that these are not really formed by the animal, but are the ready made products of the vegetable, which have only to be appropriated and put in their proper places in the body. Such is, nevertheless, the fact; these very materials, as such, being found in the structure of the plant. But the connection does not stop here. Plants and animals die. Their bodies decay and return to the earth and air from whence they sprung, to become again food for a new generation—to become, in fact, *manures*. And thus the eternal circle goes on. How wonderful then this relation, thus briefly noticed. The earth is the great storehouse and source of vegetable food. The plant receives it and prepares it for the animal, both of which must be eventually

converted into food for a new race, thus linking the whole creation together in an unbroken chain.

But another branch of the subject yet remains to be considered. We have seen that plants contain but a small proportion of mineral or *inorganic* matter. The *organic* substances on the other hand are by far the most abundant. They compose the great bulk of the plant, constituting generally more than ninety per cent of it, although they are few in number, and three out of four of them, when pure, being always found in the form of gas. They are oxygen, hydrogen, nitrogen and carbon. Unlike the inorganic matter, these are not derived solely from the earth. Indeed, it is a point not yet settled whether some of them are not derived exclusively from the atmosphere. That there is a sufficient amount in the atmosphere to furnish plants with all they require, may be true, and yet at the same time it may not be true that they receive them all from this source. If it be true, then a great error has existed, and still exists, and is increasing in extent under the authority of science, in the preparation of farm-yard manures and composts for application to the soil. Instead of preventing thorough decomposition in the dung-heap, or checking it when it has reached a certain point—instead of using gypsum or charcoal to arrest the gases as they escape from decomposing animal matter—instead of ploughing in green manures or adding any vegetable or animal matters to the land, the proper course would be to decompose all such substances as perfectly as possible, or actually burn them, thus suffering all the volatile parts to escape into the atmosphere, whilst the ashes alone are retained to be applied to the soil. Liebig himself, to whom this whole theory is often imputed, says, that *humus* is of use in the soil as a source of carbonic acid to enable the plant to gain time, that is, to increase rapidily in growth in a short period; thus admitting that this gas is derived from the soil in part, while he adds, that by this means "space is obtained for the assimilation of the elements of the soil necessary for the formation of new leaves and branches; meaning the inorganic substances."—(*Familiar Letters on Chemistry*, *Letter* 15*th*.)

But the experiments of Saussure seem to show, that the plant may not only derive its carbon from the soil in the form of carbonic acid, but that it has also the power of absorbing it in other forms and assimilating it. Practically considered, safety lies on the side

that makes both the soil and the atmosphere the sources from which these elements are drawn. It is well known that the roots will absorb them if presented to them in a liquid form, and if introduced into the circulation they will no doubt be appropriated by the plant.

Nothing in a solid form can enter into the circulation of plants. It is by means of water that they receive all their food which they take in by their roots, that fluid being the solvent of all they require. By their leaves they absorb gases and probably water also. But before any thing can enter the minute pores of the roots, it must be dissolved in water. But this is not the only use of water. It is composed of two of the gases mentioned above, viz., oxygen, and hydrogen, and is an abundant source from which the plant can receive them. And it may be proper before closing this paper, to consider in a few words the sources whence the plant derives its organic constituents.

Carbon constitutes a very large portion of the vegetable. From forty to fifty per cent, nearly or quite one-half, of all plants consists of this substance. This is derived from several sources. First, by their leaves from the atmosphere. When wood or coal is burned in the open air, the principal product is carbonic acid, i. e. carbon united with oxygen. During the process of respiration, animals give off from their lungs this same substance. About eleven ounces of this gas are said to be thrown off from the lungs of a healthy man in twenty-four hours. This mingles with the air, constituting about $\frac{1}{1000}$ part of its weight, the quantity varying somewhat under different circumstances; in the vicinity of large bodies of water, it being less, and at night more than in the day. From this source it is absorbed by the leaves of plants, which are furnished with numberless pores, serving as mouths. It is the opinion of one class of vegetable physioligists that it is in this way that they obtain all their carbon, making no use of their roots for this purpose.

But it is probable that it is taken up largely by the roots, both that which is brought down from the atmosphere in rain, and also that which is formed in the soil by the decomposition of animal and vegetable matters. These organs indeed, may be considered the true mouths of plants, by which they receive by far the greater part of their food, both organic and inorganic.

Although there are various sources from which plants may derive their hydrogen, yet water may be considered as the chief one. Of this substance it constitutes two parts in three; and being the only medium by which they can receive their food, it is constantly passing through their organs, and is there decomposed, furnishing both hydrogen and oxygen to them. Ammonia is a compound of hydrogen and nitrogen, and may have a part to perform in furnishing this gas.

Plants are surrounded with the atmosphere containing oxygen, are constantly supplied with water containing it, and are always absorbing carbonic acid of which it is a constituent; and therefore no one will be at a loss to find the source from which plants procure this gas.

Although nitrogen forms a large part of the atmosphere and a very small part of plants, it does not appear that they obtain this substance from this source.

We have just stated that ammonia consists of hydrogen and nitrogen, and it is an abundant product of the decay of animal and vegetable substances. This is the substance commonly called hartshorn. It is known to exist in the juices of some plants already formed, and is absorbed in large quantities by water. It exists in the atmosphere in very small quantities at all times, and being washed down by rains, is brought in contact with the roots. Thus passing into the circulation, it is decomposed and its nitrogen appropriated.

Another source is nitric acid (aquafortis.) This is also one of the products of decaying animals and vegetables. Besides this, it is produced during thunder showers, by the effect of the lightning upon the air, causing its elements to enter into a chemical union, and being absorbed by the rain is brought down and taken up by plants. The effect of some salts of this acid as manures, depends, without doubt, upon thissubstance.

We have thus examined as fully as our space will allow, the constitution of plants, and their relation to the soil. It yet remains, before entering directly upon the subject of manures, to consider some circumstances which modify their action. This will be done in the opening of the next number.

PHOSPHATE OF LIME.

It is an object of great importance to discover phosphate of lime in its pure state, or even mixed with other materials, in sufficient quantity to supply the wants of agriculture. We fear, however, that this desideratum will not be realized very soon. Although it cannot be said to be rare, yet it is not known to exist in large beds, and very rarely in small ones. The common mode of its occurrence in the mineral kingdom is either in small disseminated particles, or in crystals varying in size from a needle to five inches in diameter. When occurring in crystals it is never in sufficient quantity to meet at all the wants of farming; and in fact, these crystals are so highly esteemed by mineralogists, and so high a value placed upon them, that no one would ever think of spoiling them, or of devoting them to any other purpose than to adorn the cabinet. There are only two localities known in New-York which can possibly yield an amount sufficient to render it an object to the farmer. One of these places is seven or ten miles west of Port Kent, on Hogback mountain, at the iron ore bed of Messrs. Thomlinson & McDonald, or which is known in the Geological Report of the 2d District, as the Rutger's ore bed. At this bed it forms in some parts, nearly one-half the mass of the vein or bed; at others considerably less. It is, however, the principal stoney matter of the bed near the surface. The phosphate of lime of this locality may be obtained at the place where the ore is separated. The kind of stoney matter mixed with the ore is feldspar and hornblende, mostly the former—hence, the whole material separated from the ore could be preserved and ground like plaster, and used as a fertilizer. The best way of using such a powder, would be to put a small quantity in the earth with the seed, or apply it as directly to the growing plant as possible. Let it be understood, however, that this locality is not of very great importance; the washing of the ore, however, would supply several farmers with this invaluable substance. We have mentioned this locality that it may not be lost, to those certainly who live in the immediate neighborhood; for they ought to secure it for their gardens at

least. In the course of a year, if the ore continues to be worked, several tons of it might be procured. In using it, it should be reduced to an impalpable powder.

The color of this phosphate is red or reddish. It sometimes appears in large crystals upon the walls of the vein, but it is so extremely brittle that it will be very difficult to procure it in a good form for the cabinet; still, it is an interesting variety.

Another locality of phosphate of lime deserving of the attention of the agriculturist, is that of the Sandford ore bed in Moria or Westport. It is washed out of the ore in the same way as the former. Its color is a duller red than the former, or rather brown, and is always in small grains, and appears somewhat like the flesh-colored feldspar.

In addition to the above localities of phosphate of lime, one other is deserving of notice, which we had forgotten when we commenced our notice of the preceding. It is at Crown Point, and the mineral is known as the eupyrchroite. We discovered its locality while engaged in the survey, and as the external characters are so dissimilar to phosphate of lime, we considered it a new mineral substance. Our experiments at the time showed it to be a phosphate, but we conjectured that it contained another substance in combination. We still entertain this opinion. But the analysis of Dr. Beck shows that phosphate of lime enters largely into its composition; and as it forms a vein in the rock more than a foot wide, it is possible it may be of some importance to the farmer. It is a dull green, and fibrous and obscurely mamillary, or in the form of segments of a sphere. This substance is intermixed with silex in little masses in the interior, and on that account will not pulverize so easily as it usually does. We have not examined it, however, with the view of determining how much this locality can furnish at a reasonable expense. At the time we discovered it, we considered it rather in the light of a trap dyke, or an earthy vein; it was concealed, however, partly by soil, and hence we may be deceived as to its width, nature of the deposit, as well as to its extent.

FERTILIZERS IN THE ROCKS.

Our attention in the course of the agricultural survey, has been turned to the character of the rocks as fertilizers of the soil. The first inquiry was—do the rocky masses themselves admit of being applied as manures? and in the second place, what elements do they contain which renders them valuable as fertilizers to soils? In answer to the first question, we have ascertained that some at least of the shales—limestone shales, as they may be called—are of great importance to agriculture. We stated in one of the meetings held at the geological rooms, some of the results of the analysis which we had made: showing that they are rich in saline matter, and mostly free from the astringent salts which are injurious to vegetation. These examinations are the first which have been made in this country in this matter, and we propose to pursue them. New-York, in every district, except the Atlantic, is rich in the shales, particularly the western, or the wheat growing district. In order to use these shales, the best mode will be to raise them, throw them into heaps in prepared places and then let them crumble and decompose. The debris of the heaps may be mixed with a compost or with barn-yard manure. If the decomposing matters are astringent, mix them with sufficient lime to neutralize the salt, which will probably be mixtures of the sulphates of iron and alumine; these will be decomposed, and gypsum will be one of the resulting compounds. In addition to these salts there will be found sulphate of magnesia, which ranks high as a fertilizer.

Besides the shales, the limestones themselves are deserving of examination; but, as I have not yet advanced far in this inquiry in regard to them, I merely speak of them in this brief manner, hoping by and by to lay some important results before the agricultural community.

Of the materials which it is possible the fossiliferous limestones may contain, we may state the high probability of their being rich in phosphate of lime. Derived as they all are from primary rocks, all of which are occasionally known to embrace this substance, we can hardly doubt of its presence—especially when we connect it with the fact that much organic matter has been enclo-

sed in the rocks themselves, in combination with organic remains. All animal matter contains more or less of the phosphates, and hence as these remains of organic bodies are still enclosed in our rocks, we conceive that it must be locked up still in these sedimentary masses. Bearing upon this subject, we may state that the recent examinations of Mr. Benjamin Silliman, Jr., of the corals, bears out this conjecture. Thus, Mr. Silliman found as much as nine or ten per cent of the phosphate in some of his examinations of the corals. Is this substance likely to be lost when these corals are enclosed in their rocky beds? If a limestone with a few per cent of this substance could be found, its value for agricultural purposes would be greatly increased.

All these facts and suggestions have a practical bearing, and we are anxious the farmer should be able to avail himself of all the aids which science can afford. On this subject we propose to give from time to time, the results of our inquiries.

Phosphate of lime, we have already stated in another article, occurs in the white limestones, such as those in Orange, St. Lawrence and Jefferson counties. Of the origin of this substance there is a difference of opinion, and we hope we may be excused for occupying a short space in our columns in the discussion of this point, although it has no practical bearing; yet we believe that all enlightened agriculturists will be pleased to know as much as possible of those subjects which relate to the history of important materials—one so important as phosphate of lime.

Mr. James D. Dana, [*Journal of Science p.* 135, Vol. XLVII,] maintains that the phosphate of these limestones, although now in superbly finished crystals, originated from organic structures, from corals, which after being enclosed in their rocky prison, were exposed to intense heat, and hence were decomposed; the phosphate of lime separating from other matters composing the original coral, assumed the form and condition we now find it. In this exposure, the whole rock is supposed to have undergone an entire change, passing from an earthy to a highly crystalline mass. The idea is, that these rocks were originally deposited in the ocean, enclosing in their several beds and layers the organic bodies which then lived upon those beds; or, in that ocean—mere sediments—but by the exposures we have already spoken of, have been changed and brought to the condition we now find them. Magnesia is

another element of corals, and as many limestones are magnesian, it is inferred that these limestones have also a similar origin. Proceeding still farther, Mr. Dana infers that the magnesian minerals, as serpentine, steatite, pyroxene, tremolite, spinelle, chrondrodite, all have a similar origin; a derivation from organic matter. But now let us enquire, are these generalizations necessary? Are they probable? 1. As it regards the phosphate of lime, we have given two localities [p. 60, 61,] where it forms the gangue of iron ores; and again it exists in gneiss, mica slate and granite. Is it of organic origin here? There is no proof of it. It is only when contained in limestones that phosphate of lime and magnesia are supposed to have this origin. The question must turn then, on this point: are the relations of these limestones in St. Lawrence, Jefferson, Essex, and Orange counties, such as to bear out and sustain the hypothesis? We answer in the negative, and would add in support of our negative, their relations are such as to overthrow—to entirely overthrow it—to demolish it. The limestones which are richest in phosphate of lime and other magnesian minerals, are universally enclosed in gneiss or granite—they are in veins or beds; one in particular, which is rich in these minerals, projects out of the hypersthene rock, or comes up from below. How a sedimentary, coraline rock could get into this position remains to be shown. That it has been acted upon by heat is not denied, but that this and many other masses like unto it were originally sedimentary rocks, not a fact in existence has ever been observed to sustain the hypothesis. Again, the magnesian limestones of Berkshire county, the Stockbridge limestone, which is truly a sedimentary rock and stratified, has never furnished to my knowledge a crystal of phosphate. It is here that we ought to find it, inasmuch as it is granular or crystalline, and may have been formed at a period when animals dwelt in the seas upon whose bottom it was deposited. But once more and we shall drop the subject. We wish to be understood not to deny the possibility of changes of the kind Mr. Dana speaks of. We deny the propriety of the application he has made of the facts to the limestones of the counties mentioned above. For a full account of this origin we refer the reader to the Geological Report of the 2d District.

FREE MARTINS.

When a cow produces two calves, one of them a bull calf, and the other a cow calf, the cow calf is known by the curious name of *Free Martin.** The male becomes in due time a perfect and useful bull, but the female is generally supposed to be incapable of propagation.

This belief is prevalent, not only in this country but elsewhere. An opinion so wide spread and so fully believed, not only by the ignorant and vulgar, but experienced and intelligent cattle breeders, would seem to be worthy of some degree of credit. It certainly merits investigation.

The first point of inquiry, is to determine whether it is an *invariable* rule that free martins will not propagate. In order to ascertain how far this opinion, so generally received, might be correct, I made careful inquiries among many who were engaged in rearing cattle, and also examined such journals and books as would be likely to furnish information on the subject.

It soon appeared beyond a reasonable doubt, that free martins *were not necessarily barren;* yet as a general rule, subject to a few exceptions, they will not breed.

A gentleman of veracity, residing in Buffalo, and well known to many agriculturists throughout the state, informed me that he reared a free martin on his own farm, and that she afterwards calved. This animal is still living, and is on the farm of L. F. Allen, Black Rock. An English gentleman informed me of an other instance in England, which occurred under his own observation. The heifer died of disease, and on examination after death was found to be pregnant.

Two cases of free martins propagating are recorded, and a third related on hearsay evidence in the American Agriculturist, Vol. III. No. 3, March, 1844, by Joseph Cope of Pennsylvania. An anonymous writer in the Farmers' Magazine, for November, 1806, describes a free martin, belonging to Mr. Buchan of Killingtringham, which had a calf, and proved to be a good milker. Another writer in the same Magazine for November, 1807, raised a free martin, which bore when two years old a fine male calf.

* Cattle; their Breeds, Management and Diseases, &c., by W. Youatt. Philadelphia, 1836, p. 538.

These are the only free martins I can ascertain on sufficient evidence to have propagated, while there is abundant evidence, equally good, of a very considerable number which had been faithfully tried and proved barren.

It would hence appear that the rule is, singular as it may seem, that the female twin is unfruitful, yet in a few rare instances she is capable of breeding.

It becomes then an inquiry not of physiological curiosity alone, but of practical value, to learn upon what the barrenness depends, and how the fruitfulness or unfruitfulness of the calf may be known in early life.

It is established with tolerable certainty, that the free martin when incapable of propagating is anatomically deficient, or deformed in some of the organs of generation ; and these deficiencies or deformities very plainly and with a great degree of uniformity, modify her external form and appearance. We accordingly find heifers of this description coarse and masculine in structure ; and in the head and horns especially they exhibit a very marked approach to those of the ox : the teats are smaller than is usual in the heifer : she manifests no propensity to breed. The external appearance of the vagina is the same as in other cows.

Some of these distinctions are of course not developed until she has arrived at the age of bearing. The internal structure is marked by still greater differences ; these, however, are not to be seen except by post mortem examination.

The first, and so far as I know, the only scientific investigation, was made by the accurate and distinguished anatomist John Hunter. He examined three of these free martins, and found in them all a greater or less deviation from the form of the female, and the addition of some of the organs peculiar to the male ; they were in fact *hermaphrodites*.

The subjoined description of one of them is taken from the Philosophical Transactions, Vol. LXIX. p. 289.

"Mr. Abuthnot's free martin, seven years old. The external parts were rather smaller than in the cow. The *vagina** passed on as in the cow, to the opening of the *urethra*,† and then

* *Vagina* is a technical term ; the common name I believe is *bearing*.

† *Urethra* is the passage for the urine from the bladder.

it began to contract into a small canal which passed on to the division of the uterus into two horns, each horn passed along the edge of the broad ligament, latterly toward the *ovaria*.

"At the termination of these horns were placed both the *ovaria* and the *testicles*. Both were nearly of the same size, which was about as large as a small nutmeg. To the ovaria I could not find any fallopian tube.

"To the testicles were *vasa deferentia*, but they were imperfect. The left one did not come near the testicle; the right one only came close to it, but did not terminate in the body called the *epididymis*. They were both pervious and opened into the vagina near the opening of the urethra.

"On the posterior surface of the bladder, or between the uterus (womb) and bladder, near the two bags called *vesicula seminales* in the male, but much smaller than they are in the bull, the ducts opened along with the vasa deferentia. This animal then had a mixture of all the parts, but all of them were imperfect."

Mr. Hunter also states that in external form they bore a marked resemblance to the ox.

Free martins, however, even when barren, are not always hermaphrodites; they may be simply deficient in the sexual organs peculiar to the female. In this case their form is not necessarily masculine, yet it is so in the majority of instances.

About a year since I examined a free martin of this description, reared by Frederick I. Betts, Esq. of this place, (Newburgh). She was about three years old, and in external form and appearance presented nothing different from other cows. She manifested the sexual propensities, even to a greater degree than usual; indeed she was almost constantly in season; yet she never became pregnant, although faithfully tried.

In the structure of the internal organs of generation, there was no mixture of male parts, but a very marked departure from the natural structure of the female.

The *vagina* externally presented the usual appearance of a heifer which had never borne a calf. It passed on, as in the heifer examined by Mr. Hunter, to the opening of the urethra, when it begun to contract into a small canal, which passed on for six inches, where it terminated in a closed sac, one inch from the mouth of the uterus.

The *uterus* was perfect in structure, but exceedingly small.

The *ovaries* were small, corresponding in size to the womb; their structure presented no well marked difference from other cows.

The *fallopian tubes* were also perfect, but likewise small.

The womb and appendages, in fact, very nearly resembled the same parts in a calf a few weeks old. The following estimate of the size and weight of the vagina, uterus, &c., of a cow, a calf, and the free martin referred to above, will exhibit the extent of the deficiency in size, &c.

Cow, after two years old.

Length of vagina 14 to 20 inches; circumference of vagina about 8 inches. Length of the womb 12 inches; circumference of the womb 1½ inch; weight of the whole from 1 to 2 pounds.

Calf, four weeks old.

Length of the vagina 6 inches; circumference of vagina 2½ inches. Length of the womb 2½ inches; circumference of the womb ⅝ths of an inch; weight of the whole 1 ounce.

Free Martin.

Length of vagina 8 inches; circumference of vagina near the mouth 2 inches; circumference of vagina at the middle ⅝ths of an inch. Length of the womb 2¾ inches; circumference of womb ⅜ths of an inch; weight of the whole 1¾ ounces.

In taking the length of the womb, I measured from the mouth to the extremity of one of the horns of the womb. I took the measure in this way, because there is more uniformity in the size of the horns, than in what is usually termed the body.

The accompanying plates will aid in understanding the structure of these parts.

Fig. 1 represents the natural appearance of the vagina, womb and ovaries, as they appear externally when removed from the body.

a. is the external view of the vagina.

b. represents the situation of the mouth of the womb, which is fully exposed in Fig. 2.

c.c. are the ovaries.

e.e. the two horns of the womb.

Fig. 2. represents the same parts, with
a. the vagina, slit open to show
b. the mouth of the womb.
c.c. the ovaries.
d. the urethra opening into the vagina.
e.e. the horns of womb.

Fig. 3 represents the same organs, as found in the free martin belonging to Mr. Betts; the vagina being slit open to show its extent and termination, an inch beyond. The mouth of the womb is represented by the dotted lines *b*.

From these dissections it would appear that there are two varieties of free martins.

The first, and by far the most common, are probably hermaphrodites. They are more or less masculine in appearance, and manifest no desire for the male. They will even work, it is said, with an ox; I knew an instance of the kind in this county. This variety, so far as I can learn, *never breed*. This conclusion, made as it necessarily is, from comparatively slender materials, may be erroneous; yet I think there is sufficient evidence to afford a reasonable ground for the opinion. It is worthy of notice that the Romans called their barren cows *tauræ*, as if they had something of the bull about them. But it is not stated that these tauræ were free martins, although the supposition is not improbable. Columella* speaks of "*tauræ* which occupy the place of fertile cows, and should be sent away." Varro† also calls the barren cow *taura*.

The second variety of free martins resembles other cows externally, being feminine in appearance and exhibiting the usual sexual propensities. Those belonging to this class *may breed*, or they *may not*: generally, however, they will not. I know of no external mark by which the barren of this latter variety may be distinguished from the fruitful. Future investigations may discover some external mark, but at present it is mere guess work.

A free martin calf, then, that resembles a male in external appearance, and especially about the head, may safely be condemned as unfruitful; and even if she is not masculine in appearance, she may still, in nine cases out of ten, be also condemned as

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* Lib. vi. cap. 22.

† *De Re Rustica.* Lib. ii. cap. 5.

equally useless for breeding. The farmer that raises a free martin for a breeder will, in ninety-nine cases out of a hundred, be disappointed in his expectations.

If these conclusions are correct, they afford a most singular anomaly to the usual order of generation. Why twin heifers or twin bulls should be fruitful, and a free martin barren, is utterly inexplicable upon any known or supposable principle of physiology. Yet, strange as it may appear, observation would seem to establish the fact as a general rule, and we are obliged to admit it, notwithstanding our unbelief and its apparent inconsistency. The subject is well worthy of further investigation, and farmers having free martins born on their farms would confer an especial favor upon many others, if they would have them carefully examined, after death, by some person acquainted with the natural structure of the organs of generation. It is not necessary to keep the animal until grown, if this is not convenient, as the organization of the parts can be sufficiently seen in the youngest calf.

There have been instances of the cow producing three and even four calves at one birth; but there is, I believe, no mention in these cases of the procreative power of the female. I examined one cow whose womb contained *four* calves; all of them were females, finely formed, well developed, and bearing a close resemblance to each other. In each of these calves the organs of generation were perfect; and had the calves been born and reared, there was no anatomical reason why they should not all have proved good breeders.

I also met with two heifers which were barren. In one there was a fibrous plug, closing the mouth of the womb, and which, according to the prevalent opinion of generation, would necessarily prevent impregnation.

In the other, the womb had two mouths, instead of one. Yet this does not necessarily cause unfruitfulness, for I subsequently dissected a cow whose womb contained a calf, and yet had two mouths.

There are many other interesting topics connected with these investigations, which I may resume on some other occasion.

Newburgh, January 1st, 1845.

NEW PUBLICATION.

A treatise on the forces which produce the organization of plants, with an appendix containing several memoirs on capillary attraction, electricity and the chemical action of light, by John W. Draper, M. D., Prof. of Chemistry in the University of the city of New-York.

The title of this book and the high reputation of its author, strongly incited us to give it an early perusal. We were wishing also to furnish our readers with some abstracts from its pages that we might be instrumental in awakening in them, if need be, a taste for a higher order of inquiry than is found in the ordinary treatises on the physiology of organic beings. Probably no field has ever been opened so rich in facts, so important in results, and at the same time so attractive to the philosophic mind, as an inquiry into the nature of those forces which produce organization; and if the mystery which hangs over the production of organic bodies, if the secrets which belong to life are ever dispelled or revealed, it will be by labors in this field of research. It is true that it is not a new field, one that is just opened or just entered, for many keen sighted men of former days, men profound in knowledge and skilled in philosophic analysis have made those forces the subject of anxious and serious inquiry. That these inquiries have been eminently successful we by no means assert. Surrounded as they necessarily are with great and serious difficulties, partly from the nature of the forces themselves, but mainly from the circumstance that they become known to us solely from their effects, it can hardly be considered strange that they should have often terminated unsatisfactorily, or without obtaining positive results. Still those inquiries have been at least partially successful; and hence instead of losing their interest, they are at the present time awaking and exciting more attention than at any former period. The work of Professor Draper is divided into two parts. The first is a compilation, as we call it, of the views of modern philosophers on subjects relating to the forces concerned in organization, or those which have a hand in developing vegetable and animal bodies, as the action of the imponderables, light, heat and electricity. The second part is made up of memoirs written at different times and published in the journals of the day. Among them we find one on capillary attraction. Another on the various

phenomena of light and heat, the rays of the solar spectrum. Another of still more importance treats of the *tithonic ray*, or the chemical rays of former writers. These essays are well illustrated, and the peculiar doctrines supported by numerous well devised experiments, the manipulations and arrangements of which are neatly demonstrated by diagrams on copper. Of the first part we feel bound to say that it is written in philosophic language, that it bears the impress of a philosophic mind, and that an air of importance and originality appears throughout the whole production, and that even the commonplace ideas are so well expressed that they bear the aspect of new thought and original suggestions. It may truly be called a labored treatise, a well-wrought production abounding in valuable matter, which, though it cannot be claimed as original or new, still, the labor expended in putting together the materials, entitle the author to a share of the credit which is awarded to originality.

Having expressed our views of the general merits of the work, we proceed to notice some of the doctrines which Prof. Draper has expressed, and which he has attempted to maintain. We must premise, however, that of these doctrines we find it necessary to make a selection, and to confine ourselves within narrow limits, for it is impossible to notice, even summarily, all the opinions and doctrines which are expressed in the first part of the work. The treatise is introduced with some general views of the influence of physical agents on organization and life, in which he has given brief expositions of the nature of organized combinations, the changes which are effected by physical laws, and how they effect the extinction of living races, also on the relations of organized forms to the atmosphere, and closing with a notice of that law which secures or which emancipates the higher races from the direct dominion and action of external agents. Prof. Draper, in the second section of the introduction, takes this early occasion to express his decided dissent from the views entertained by many physiologists in regard to the existence of a vital force. As this is one of the leading doctrines of the work, we shall extract the passage in which he announces his views.

"In this work the existence of the Vital Force of physiologists—as a homogeneous and separate force—is uniformly denied. The progress of science shows plainly that living structures, far

from being the product of one such homogeneous power, are rather the resultants of the action of a multitude of natural forces. Gravity, cohesion, elasticity, the agency of the imponderables, and all other powers which operate both on masses and atoms, are called into action, and hence it is that the very evolution of a living form depends on the condition that all these various agents conspire. There is no mystery in animated beings which time will not at last reveal. It is astonishing that in our days the ancient system which excludes all connection with natural philosophy and chemistry, and depends on the fictitious aid of a visionary force, should continue to exist; a system which, at the outset, ought to have been broken down by the most common considerations, such as those connected with the mechanical principles involved in the bony skeleton, the optical principles in the construction of the eye, or the hydraulic action of the valves of the heart."

Such, then, is the view of Prof. Draper of the vital force; which, though we are not yet ready to subscribe to, we are aware that the tendency of the in-coming philosophy is to support them. We, perhaps, are not informed of the whole argument which disprove on the one hand the existence of a vital force, and on the other demonstrates that what has been attributed to it belongs wholly to physical forces, as gravity, cohesion, elasticity and the imponderables. We see not why we may not subscribe to the doctrine that the evolution of a living being has some dependence upon those agents or upon the joint action which they conspire to produce, and yet consistently maintain the separate existence of a homogeneous vital principle. The evolution of a complex or even simple structure may depend on physical agents, that is, without those agents the evolution could not proceed. The seed of a plant, for example, contains a vital principle according to most physiologists; still, this principle will remain at rest, will not of itself evolve a fabric or organic body, in the absence of heat and moisture; and though the evolution is thus dependent, it by no means militates or overturns the doctrine that prior to evolvement that principle had an existence in the germ or seed. So the green scum upon stagnant water which appears to be evolved by the agency of light and heat; the living atoms which dance upon the water, the monad which floats there and teems in every dead pool, living atoms generated in death, are no more the products of sunlight

and caloric, than the principle at rest in the egg and seed. There is something before evolution, something behind the curtain, which to be sure we cannot see, which makes it possible for light, heat and electricity to evolve the specific being. But what is still more important, we cannot conceive how, even by the joint action of light, caloric and all other physical agents combined, a given being is just what it is—how those forces should develop from a germ one specific being and not another. The early stages of all organic beings are so similar that it is extremely difficult to detect any differences among them; and modern observations have established the fact that at one period the higher and more perfect beings pass through stages during development when their organization is that of some lower and inferior tribe. Now, on the principle that the mere mechanical forces develop a being, and impress upon it its type, or give it its characteristics, we are wholly in the dark how such certain results can take place—how the chick, for example, when it is in that stage where it is taking on the organization of a fish, it should not go on in its development and become a fish rather than a fowl. There must be, then, it appears to us, a principle, call it if you please a vital principle, in organic beings which holds some control over physical force, independent of it, and gives such a direction to all those movements which will end uniformly in the production of a specific being in any given instance. How beautifully this is illustrated in fermentation. Do we see the leaven in the flour? No: but still it is there—we know it by its workings; every particle is moved; it pervades the whole mass; it prepares it for the oven; so, though we are unable to see the vital principle in its simple homogeneity, we may still see it in its action. Inquiries however, of this nature, we confess, are on the outskirts of the boundaries of our knowledge; they are surrounded with a dim haziness or twilight, so that it is impossible for us to separate clearly the known from the unknown. It is therefore important when we push our observations into this dim circle, that we mistake not on the one hand that which is only probable for that which is certain, and that we continue to feel dissatisfied with our evidence so long as it is possible to push our observations farther. There is undoubtedly sufficient light already evolved upon this and kindred subjects, to encourage us still to push forward our investigations; at the same time, however, we should

bear in mind that we shall sooner or later reach those ultimate facts of which no account can be given, except that they bear the sole impress of the finger of Deity.

Professor Draper evidently belongs to the sanguine class of philosophers, if we may be permitted to judge of character from many expressions which he has recorded. There are no mysteries in animated beings, says Prof. D., which time will not reveal. Admit it, and admit also that physical agents are the prime movers of organized atoms or beings, from beginning to end, we still assert that not a whit of this mystery would be removed, rather we are inclined to say, that it would be increased. Undoubtedly organized beings are subjected to conditions; the living cell as well as man was adapted to pre-existing physical agents. There is a terrestrial plan, and the physical agents, ponderable and imponderable, must mould and shape that plan; so far as movements are concerned, they may exalt and sustain those movements, they may give a higher degree of sensibility; still they cannot originate the smallest spark of vitality, though if need be and if proper conditions exist, they may blow it into a flame when once the spark has been struck out.

We have, perhaps, dwelt too long upon the introductory chapter. We proceed, then, without farther comment, to the subjects of the first chapter of the work. It is entitled, "On the action of the sunbeams in producing organized bodies." Light is here shown to be the agent in developing the green color of vegetables; it directs their growth. Leaves placed in carbonated water in sunlight decompose the carbonic acid: the oxygen is disengaged and escapes in bubbles: the carbon enters into combination with other principles or elements already in the tissue of the plant, and forms with them the mucilage or some other compound, which administers to its growth. Living leaves in air, perform the same function, absorbing the carbonic acid, where it is decomposed as before, and even more energetically than when immersed in carbonated water.

Chapter II. treats of the flow of sap in plants. It is due to the carbonization of water in the leaves by the light of the sun.

We shall condense Prof. D.'s views on this subject, as it will enable us to economize both our time and space.

1. Capillary attraction is the physical cause of this movement. The constitution necessary for capillary attraction to take place, is

that the fluid into which the fine tube is plunged, should be able to wet the tube; thus water wets a glass tube, and hence rises above its hydrostatic level, but quicksilver will not wet glass, therefore it does not rise. It is not necessary that the instrument should be in the form of a tube in order that the fluids may be elevated above their hydrostatic levels; a sponge, the cellular tissue, or any porous body, is, to all intents and purposes, a capillary instrument, capable of lifting water; even the passages between cells are exceedingly short tubes.

2. From these facts the following law is deduced, viz: When two fluids are brought together in contact in a porous solid, or series of capillary tubes, which is wetted by both, but unequally, that one which wets the porous solid most, or for which the attraction is strongest, will pass most rapidly through it, and may drive the other entirely before it. To make the law plainer, it is observed, that the structure of plants and animals is like a congeries of capillary tubes, particularly in vegetables, the leaf and the spongiole of the root.

Now for the application of the principles to the circulation of sap. The ascending sap is derived from the ground by the action of the spongioles; it passes upward by the woody fibre and ducts of the alburnum to the upper surface of the leaf. A change takes place here by sunlight; it obtains carbon, and forms a thin watery solution, becomes a mucilage; this mucilage being now elaborated sap gains the under surface of the leaf, and returns back through the cellular tissue, finding its way by the medullary rays to all parts of the plant. The descending sap in the spongiole is mucilage, and from this fact is derived the reason why water will enter the spongiole from without. The experimental fact and proof is deduced from the following: Put sweetened water in a bladder and immerse it in simple water, the latter flows in, and the former out. The bladder is a congeries of capillary tubes; the flowing in and flowing out is nothing more than capillary attraction. It is the mucilage or the descending sap which reaches the spongiole which enables the water to enter, and having entered, rises in the stem. So in the leaf, with the mucilage on one side and the water on the other, the latter drives the former before and makes it descend, the tissue of the leaf having a greater attraction for water than for mucilage.

This, then, is the doctrine of the circulation. Is the doctrine proved? We say, not clearly so. The assumption upon which it is partly founded, is not, to our mind, well established. The ascending fluid is not water with some saline matter in simple solution; it is already mucilage long before it reaches the leaf. What is the ascending sap of the sugar maple but mucilage, or a fluid already partially elaborated?

2. The analogy between the spongiole of a root and a bladder is assumed also; for in order that the analogy should hold good, the mucilage in the spongiole should flow out while the water in the earth flows in. This is far from being proved.

3. No provision is made in this theoretical circulation, for the growth of the branches, or for the flow of sap before the expansion of the leaves.

As our views in relation to the circulation of sap differ somewhat from those of our author, we propose in a very few words to give an exposition of them. We must observe, however, that we have never been satisfied with any explanation which we have yet seen.

Water holding in solution carbonic acid, together with the saline matters which are common in soils, is received into the spongiole and ascends through the newest parts in the greatest abundance. It partakes of the nature of nutritious matter soon after it is received into the tissue of the plant. It reaches the dormant bud in which the rudimentary leaves and branch are folded. It furnishes the nutriment whose elaboration now completed in the still imperfect parts by light, and the leaves are in consequence developed, or in other words grow; the basal leaves first, the others in succession, and as long as leaves remain whose foundations were laid in the bud the branch elongates, and it seems or appears to elongate solely by the development of the leaf at the termination of the branches. In about three or four weeks after the sap begins to rise the branches have attained their full growth; all this is effected by the ascending sap. While the leaves and branches are thus arriving to maturity the sap only flows feebly downward, but during this process sap accumulates in the newer parts, especially be tween the bark and wood last formed. Here it becomes pulpy and soft and penetrable. The ascending sap in the mature leaf undergoes those changes which have been so frequently described by wri-

ters upon physiology, and then passes through the inosculating vessels between the upper and under surface of the leaf and circulates downwards, or the full flow downwards is now established and its progress deposits the matter which is to form the next annual layer, which is in fact nothing more than a fibre or root proceeding from each leaf, penetrating through the already formed pulpy matter of the ascending sap. It, however, descends, passes into the root, where it deposits the matter which is to elongate this part of the plant. The whole end of the circulation is this: by the ascending fluid the buds become leaves and branches; by the descending aliment the roots extend outwards and downwards, while both currents assist in the formation of the annual layers.

This exposition, however, leaves out of view the special force by which the currents were moved, and it is rather a statement of what is effected by the ascending and descending fluids. The roots may require the elaborated sap, that which has undergone a change in daylight.

But there are many instances where the woody fibre is formed by the descending sap—the pandamus, for example; and then there are still other cases where a tree has survived accident, and has increased in diameter by the descending fluid. Thus, when the entire bark, near the root, has been destroyed, we have seen it survive the injury, the whole root, together with an inch or two of the trunk being in a state of perfect dryness, like a piece of seasoned wood, and yet the upper part was covered with leaves, and several annual layers were already deposited down to the injured part. It is evident, then, that plants possess the power of accommodating themselves to circumstances, and their circulation will go on though not a spongiole exists, or a root from which a spongiole can spring.

A tree from which a ring of bark four or five inches long has been removed, will frequently survive the injury, and its trunk, both above and below the removed ring, will increase in diameter. Two pine trees opposite the cantonement at Plattsburgh, are still standing and growing in this condition. The growth upon the lower margin is upwards, and laps upon the dry portion of the ringed part, so that should those trees continue to live and grow, this part will entirely close up by a deposition from below, while not a single layer is deposited upon the apparently dead part at

the upper margin; but two inches above the upper margin the diameter of the trunk has increased, since the injury, nearly twice as much as that below; the shape, too, of the upper margin is different from the lower, the former being quite oblique, the latter direct. There is no branch below the wound.

The third chapter of Prof. Draper, on the chemistry of plants, treats of the circulation of the blood, or rather the mechanical cause of the circulation. In this essay, contrary to the common notions which prevail, the movement of the blood is not due to the action of the heart, or at least it plays quite a subordinate part. What, then, is the power which moves the blood? Prof. Draper maintains that this power is obtained from the affinity which arterial blood has for carbon. Thus, p. 36, § 114, "The oxygenizing action of the arterial blood is, therefore, the true cause of the systemic circulation." The principle upon which this power is based is, "*that if two liquids communicate with one another in a capillary tube, or in a porous or parenchymatous structure, and have for that tube or structure different chemical affinities, movement will ensue; that liquid which has the most energetic affinity will move with the greatest velocity, and may even drive the other liquid entirely before it.*"—p. 35.

Now for the facts and their application: the arterial blood going from the heart outwards into the parenchyma or cellular structures, contains an excess of oxygen, which it has just received in the lungs; this oxygen is ready to combine with or burn out any carbon in those structures, hence it moves towards them. When, however, this affinity is satisfied, or when the oxygen is neutralized by carbon, and perhaps by hydrogen, it is prepared to leave these structures. It is then, however, venous blood. Now, as the movement in the arteries is sustained by the affinities of the oxidized blood, and as it moves towards them, the venous blood is driven before the arterial. We will not, however, dwell upon this subject, but refer our readers to the book itself, only we wish to make two inquiries: first, admitting the chemical affinity which is supposed to exist between oxidized blood and the parenchymatous structures, shall we not be obliged to admit also that this affinity acts at sensible distances? and second, how and by what force is the circulation carried on in the lymphatics and lacteals?

Passing over those chapters which are devoted to the considera-

tion of the physical constitution of the sunbeams and the prismatic spectrum, we shall detain the reader a moment only with the contents of chapter sixth, in which it is satisfactorily and very beautifully shown which of the rays in the sunbeam decompose carbonic acid, and at the same time turn the vegetable organs to green.

It is probably known to all of our readers, that light, as it comes to us from the sun, contains several distinct principles, each principle impressing the visual organs in its own specific manner, each producing a sensation which we call light; thus, one produces red light, another yellow, and another violet light. These principles are separated from each other when light passes through a triangular prism of glass, and each color, when the rays have passed through the glass, occupy upon a plane upon which they are received, a certain position, but shading gradually into each other. In common language, the rays are called different kinds of light

As it has been shown that light exerts a very important influence upon plants, an interesting inquiry arose, viz: by which of the rays of light are vegetables most affected? Is it the compound white light, or is it one individual ray, which decomposes carbonic acid, and gives the green color to them? To give a satisfactory answer to these questions many experiments have been made with the different kinds of rays. In some experiments, light was made to pass through colored glass, or colored solutions—as the yellow, red, orange, violet. By a series of experiments made by colored glass, the fact has been discovered that the different kinds of light act very differently upon plants; thus, yellow light gives the green to vegetables by decomposing carbonic acid, whereas plants exposed to the action of the other rays, the same effects were less and less in the proportion to their illuminating power.

As colored glass does not transmit a pure ray, or one unmixed with the others, Professor Draper first employed the rays separated by the triangular prism of glass, and exposed plants directly to each kind of light, by a set of tubes. By this arrangement the light was made to fall upon the plants growing in boxes, and arranged in such a way that a comparative estimate could easily be made of the effects of each ray upon the same plant.

This plan of experimenting resulted in a very gratifying manner,

confirming the experiments which had been previously made in Europe. Under yellow light transmitted through a tube, so as to exclude all extraneous light, decomposition of carbonic acid takes place in the leaf.* When, however, a plant or leaf is exposed in carbonated water to a violet ray, no such change ensues. Digestion then in the leaf is promoted by the light of the solar beam, and that kind of light which illuminates the most is also the most energetic in promoting the growth of plants. For this reason in part, vegetables growing in a clear bright sky, are greener and more vigorous than those growing in a darker region or one frequently overcast with clouds. The effect of light is seen by the position which the growing branches always assume : in a green-house, or in a pot standing in a window, they always direct them to that quarter from which they receive the most light. The south sides of trees in open fields grow the fastest upon that side. The rings of growth are thicker than upon the north side. Trees in a forest produce their branches mostly at the summit. But light, however, is not the sole agent in promoting a vigorous growth. The presence of carbonic acid in the atmosphere, vapor, and temperature, exert their share of influence. We do not, however, subscribe to the doctrine that there ever was a period when a greater amount of carbonic acid existed in the atmosphere, than at the present. Admit this fact, and it would then be necessary to admit another, viz., that the light of the sun was also greater, for, by an increase of light only, could an additional quantity of carbonic acid be digested. For ourselves, we believe that the present volume of the inorganic forces was established as early as the creation of organic beings.

The twelfth and last chapter of Professor Draper's work, is "*On the nervous agent in plants.*"

It is well known that in order that a being should possess sensibility, it must be provided with a nervous apparatus or system, and furthermore, in order that it may hold relations to the external world, this system is equally necessary. Plants have not been

* It is proper to add in regard to the effects of colored light, that they do not seem to be sustained by experiments reported in the Journal of the Franklin Institute, where yellow light appeared to destroy, or at least injure, the vitality of seeds. In the experiments referred to, the blue and green rays appeared to exert the least favorable influence on seeds, and the young plants which were produced from them.—EDS.

provided with a nervous system. They are, therefore, insensible to what we term pain; neither can they hold those relations to the external world which are held by sensible beings. But as plants are thus deprived of a nervous system, is there any thing in nature which supplies its place? Professor Draper answers this question in the following paragraph, p. 102.

"If thus, in animal existence, we find the various nervous machines divided off, and the impressions of light, of sound, of taste, committed to a separate apparatus, how is it with plants? The rays of the sun are the true nervous principle of plants!"

We have not noticed this paragraph for the purpose of comment, but have given it to our readers for their consideration. It is, we confess, a beautiful idea. It is, however, too imaginative to be admitted into a philosophical treatise. The resemblance and analogies between plants and animals, are too distant; the types upon which they are constructed are too dissimilar to admit of the comparison; and in fact, we scarcely allow ourselves to compare the organs of vegetables with those of animals. We might as well call the solar beams the muscular system, as the nervous, inasmuch as plants bend towards the light.

We have already expressed our views generally of the work of Prof. D. It contains probably, all that is known of those forces which modify the growth of plants; or in other words, it contains a full exposition of what is termed the chemistry of plants. The subject is, however, followed out so much into details, that it takes a very wide range, embracing therein considerations relative to botany, physiology, geology, chemistry and natural philosophy. The work is in quarto of 324 pp., well printed, and on good paper.

FARMERS' MISCELLANY.

DRAINING.

BY JESSE RIDER, SING-SING.

I THINK that the nearer we can bring theory and practice into juxtaposition, so as to compare the deductions of reason with the truths of experience, the more likely we shall be to come to correct conclusions in regard to both. I look upon a theory as worth but little unless it is to aid in some practical operation; and that practice which is not enlightened by some general principles, which which when arranged are the theory of the operation, must be very poor indeed. Therefore it is that the theories of the learned, and the practices of the unlearned, should go together in the same work. It will tend to reduce theory to practice, and practice to theory, and thus aid us in coming at the truth.

In accordance with the foregoing, I have determined to furnish a little of the practical to mix up with your theoretical cogitations, hoping that nobody will be the worse off for what I write, in case any body should happen to read it. But before I proceed to farming operations, I think it is best to put the farm in a state fit for cultivation, by as thoroughly draining the parts requiring it, as is possible, and in the most judicious manner. And first,

OF THE LAND THAT SHOULD BE DRAINED.

In my view, any upland that is too wet to admit red clover to grow freely with other grasses, *ought to be drained*, and lowland should be brought to bear timothy and red-top as the dominant grasses, by the same process.

In this section of country, I think that the upland generally claims attention; first, the smooth and handsome slopes and ridges. When in grain, the parts requiring it are pretty clearly

indicated by the absence of a crop ; but they are never so readily distinguished as when the land is in grass. The cold water that issues to the surface and flows over the land, is not congenial to the growth of the better kinds of grasses, but favors that of the coarser sort, which thrive, not so much because of the absence of better kinds, as because the better kinds cannot grow there. The coarse grass, then, indicates the parts to be drained.

In draining upland, it is desirable to bring the surface of the parts requiring it as near as may be to the same degree of dryness as the parts adjacent, in the same enclosure, because the land thereafter is to be subject to the same treatment; thus, if the balance of the enclosure is dry land, suitable for Indian corn, the parts drained should also be brought to a state suitable for Indian corn; but if the surrounding land, though too wet for grain, be dry enough to grow timothy and clover, it is best adapted to the cultivation of grass, then the draining of the wetter parts should be in reference to bringing them to the same state, and for the same purpose.

A great deal of upland is light enough to bring the best of the cultivated grasses in profusion, without an admixture of wild grass, and yet too wet in most seasons for corn. Such land frequently has its wet spots, which require draining to improve the quality of the grass. Now the question is, is it all to be made corn land, or grass land? I say, unhesitatingly, that it should all be adapted to grass; therefore, the wet spots should be drained in reference to that purpose merely.

Some land is naturally adapted to grain, other land to grass. It is more profitable to till the former and pursue a rotation of crops, than to leave it all the time in grass. In fact, the grass will so far run out of most grain land in a few years, as to impose the necessity of ploughing it up to renew the grass, if for no other purpose. But it is so clearly designed for tillage, that it is the most profitable use that can be made of it. Not so with grass land, for if that is to be made into grain land, it would require drains so numerous to take away the moisture which would be a surplus for a grain crop, as to make the outlay too great to be realized in returning profits.

What I would call thorough draining for the production of

grass, would not, in most cases, be thorough enough for the cultivation of grain. I suppose that the lowlands of Scotland afford the best instances of thorough draining heavy land for tillage, and the plan there adopted is, as I have been told, to lay the drains in parallel lines at a distance apart of about two rods, and have them lead off into large open ditches, through which the water passes away.

At two rods apart it will take about eighty rods of ditch to drain an acre, which in this country will cost to dig and fill in a proper manner, from fifty to eighty dollars, when perhaps one-quarter the expense would fit it for the production of grass.

As to draining bog swamps, such as exist in this part of the country, I will say but little, hoping the owners will take my advice with most of them, and let them renew their covering of maple, ash, birch, and elm, of which they ought never to have been more than temporarily deprived; for true it is, that when cleared it is the most incorrigible and hopeless of land—only one degree removed from solid rock on the score of profit, and oftentimes worse than nothing.

The draining they get is generally confined to setting the outlet and cutting a main ditch through to take off the water, so that cattle need not go by water to feed off the bogs. But as it is they frequently mire and die in such places. And I have noticed that those who think most of bog pasture continue to have the least hay in the spring. They generally keep too much stock, which makes a little bog grass in the spring a perfect god-send to them. Their cows come home with dirty bags and sore teats, and therefore a good excuse for kicking. After all, bog grass is but little earlier than clover on good dry soil, and if the time spent in draining swamps was bestowed on the upland, it would be of much more advantage to the owners in most cases.

The peat and muck of all bog swamps with which I am acquainted, rests on a bed of blue clay, which compels the water which falls upon them to escape laterally into drains, or by evaporation. Such swamps generally lie so level, that although they may be filled with open drains, the soil, from its spongy and retentive nature, will be too wet in the spring of most years for a crop to come forward with any chance for success. Indeed, I see

no way of reclaiming such land but to throw it into large ridges, at great expense; and then I think it would have to be dressed largely with alkalies to dissolve the muck, to secure permanent fertility. But if the time spent in ridging was employed in removing the muck and peat to the upland, it would be much better paid.

I do not think these remarks, in relation to the bog swamps east of the Alleganies, apply with as much force, and perhaps with very little force, to the swampy grounds west of the mountains; for I have observed, in travelling through the western states, that most of the swamp lands or wet prairies are covered with grass, some of which is of good quality, instead of the unsightly bogs which cover acres soon after they are denuded of wood, and that they are easily drained, and when drained make the best of corn and grass land, in fact vieing with the bottom lands in the production of corn.

The muck appears to be more open and porous, so that when drained the superabundant rain which falls upon it soon settles away so as to leave the surface soil dry enough for the roots of cultivated plants to thrive in. And I have been assured that in draining for the cultivation of grass, the water should not be settled more than eighteen inches below the surface, or it would be too dry for timothy grass; an instance of which I saw myself in Indiana, where the owner had drained too thoroughly for grass, and in order to restore it had been obliged to partially fill up the ditches.

I suppose the difference between the soils of the eastern and western swamps cannot be known without a chemical analysis of each; and as Dr. Dana has already analysed the soils of ten different swamps in Massachusetts, it only remains to procure the analysis of the soil of some western wet prairie to make the comparison, the result of which I would very much like to see.

A large portion of the land which requires draining lies between the swamps and streams and the uplands immediately contiguous to the former, and offers great advantages for draining by having sufficient descent to carry off the water. Such border land appears to need nothing more to bring it to a good state for the production of grass, than to cut off the springs and leaches that are generally confined to the borders of the upland; and therefore, the first

drains should be made near the upland, and running, as near as may be, parallel to the dividing line between the wet and dry land. Experience proves that the drains may oftentimes be made a rod or more below the first issuing of the water, which instead of continuing to flow to the surface above the drain will find its way into it beneath the surface, and thus by digging further down the descent we not only dry the parts above, but also cut off the springs to a lower depth and perhaps save the necessity of digging another drain below the first. But if the water from a lower depth still issues to the surface below the first drain, there is no remedy but that of cutting another drain below the first one, and running as near as may be parallel with the line of issues; and this should be repeated until all the water is intercepted before coming to the surface; and the various drains should be so planned as to concentrate as much as possible into other main drains which run direct as may be advisable, to the place for discharging the water, so that the fewer there are of them the less the expense in effecting the same result.

In draining ridges and upland, the land which is too wet and that which is already dry enough, very often run into each other so imperceptibly as to make it a matter of opinion where the first drain should be made. My way is to run so near to that which I am sure is dry enough, as to make it all equally dry above the drain, having reference to that breadth of land from which the water will draw under into the drain, as before stated. The judgment must direct how far below the next drain should be made, unless it be left for time to determine it. A pretty sure way would be to strike a level from the bottom of the first or upper drain, which would determine at what distance the water could again come to the surface.

If the surplus water on the surface of land which has a descent be more the result of the nature of the subsoil, than because of springs and leaches discharging on it from the land above it, the office of the drain is not to cut off the water from coming to the surface, but to receive the surplus of that which falls upon it, and which without a drain to receive it and carry it away beneath the surface, will have to float off, and thus by accumulation increase the evil complained of. In such cases, where there are no perceptible issues from the land which lies above it, but few drains are required to furnish the subterranean outlets.

And it is very often the case that other land lying below is flooded by this foreign water, which has enough to do of itself to dispose of *its* share of that which falls from the clouds, but when it is overcome by this foreign supply it is reduced to the same state of the land from whence it flows; therefore all that is required is to gather it in from its sources by the requisite number of drains and carry it through that which is naturally dry enough with a single drain, and the work is accomplished much easier than might have been anticipated.

It will readily be perceived that in thorough draining it often requires great consideration and good judgment so to lay them out and concentrate them into a main drain, as to secure the intended result with the least length of drain.

In treating upon drains made upon ridge or upland, the presumption is that they are all to be covered; if so, I am opposed to locating any main drain in the lowest part of any hollow or low place through which the surface water naturally runs, from the fact, that before the raw surface gets a covering of grass to protect it, it may be washed away by a flood, and the drain partially or wholly choked up by the water finding its way in and carrying with it earth, gravel, and small stones. The same thing might take place in case the land was ploughed; but I am opposed to ever ploughing land that is blind drained, unless, as I have before observed, it lies in with other land which is too dry for permanent meadow or pasture ground, unless there is some overruling necessity for it; for it is just the kind of meadow land which is most profitable, and can be made to produce a much heavier burthen than any newly seeded land.

The soil of muck land that is drained, is beforehand stiff, wet, and heavy; after draining, some five or ten years must elapse before it is completely lightened and ameliorated, unless the operation is forwarded by enriching it with manure.

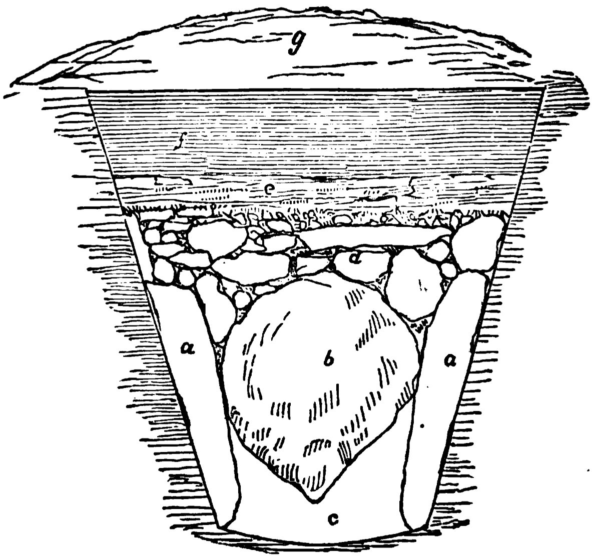
Filling a drain being attended with considerable expense, and lifting one which has become choked up, being still more expensive, I would advise that whenever they are dug through a mucky or alluvial soil the banks be made sloping, and the earth scraped back and spread over the surface of the ground, so as to mow or pasture quite to the bottom of the ditch; which, when neatly done,

will look very well, and be no great impediment to business operations on the farm. That makes the ditch a permanent affair, by preventing the banks from slipping in and filling it up. Whenever it needs cleaning or deepening, the earth from the bottom will afford an excellent top dressing for the grass ground in the vicinity. In fact, I consider one of the advantages of draining consists in bringing up the subsoil and mixing it with that of the surface.

OF DIGGING AND FILLING DRAINS.

After having fixed on the site for a drain and staked out one side of it, begin at the lower end and stretch a line between the first two stakes, then have the ditches with the spade cut through the sod by the side of the line, then set over to the other side of the intended drain and renew the operation there. The work is then rightly begun, which is half the battle. The sod is now to be thrown on one side of the ditch and the loose earth on the other, because we want the sod after the stones are in, to place grass side down upon them, to prevent the loose earth from getting in before the covering of the ditch can sod over.

In regard to the size and shape of the drain, I prefer having them three feet wide at the top, three feet deep, and not to exceed fifteen inches wide on the bottom; but that breadth of bottom does not admit of trunking the drain, or in other words, making a bridge for the water, neither do I want that it should for my method of filling, which is this: Get flat stones, or those that are flat on one side at least, and set against the sides of the drain with the thinnest ends or sides down, and the flattest sides against the banks of the drain; they should be from eighteen inches to two feet high as they stand in the ditch, and are kept firmly to their places by a third stone between them, as round or dumped as we can get it, and of a size to wedge in, and thus crowd the flat stones against the banks of the ditch, but it must not go near the bottom of the drain unless it has a thin edge down, which would do no harm. The water course is beneath the keystone. But of all this I can give a better idea by the annexed cut or figure of the drain, (being an end view,) and its filling.



a.a. Side stones.
b. Keystone.
c. Water course.
d. Filling of stones.
e. Covering of sods.
f. Filling of earth.
g. Covering of earth.

After the keystones are in, I proceed to put in the largest of those which are on hand; but there is this to be observed, that the flattest stones, and the larger their surface the better, so they be not too high, are first selected and placed with their flattest sides against the sides of the ditch to keep the banks to their places, and then of the stones that are thrown in promiscuously care should be taken to have them lie as level as may be, with their flattest sides up to intercept earth in its passage down; the nearer we come to the top the smaller the stones should be, and break joints with them as much as possible, and my practice is to break some on the top of the filling with a hammer, to the end that every crevice may be filled up. Then invert the sods upon them, and last of all with a road scraper, scrape on the loose earth and round it up over the drain.

In this section of country we sometimes have severe frosts without a covering of snow on the earth to prevent its getting in deep. Sometimes it freezes to the depth of two feet or more; and I see no reason why it should not work upon, and loosen the sur-

face of the banks and cause them to run in and fill up the drain, unless they are protected by stones as I have mentioned.

There are advantages in constructing and filling drains in the manner here represented, which I will mention. There is much less hard-pan to pick up and throw out; there is scarcely a possibility of the banks working in through the action of frost, or their being filled with earth, so long as the land remains in grass; they will be much easier taken up in case that operation ever has to be performed; it takes far less stone to fill them, and when filled, if they should wash out at the bottom, the stones cannot settle down and obstruct the water course, because their pressure is lateral against the sides of the drain. I will venture to say that this is the very best method of filling a drain where the materials can be procured without too great expense. The materials should be on hand before the ditch is dug, and when dug it should be filled immediately.

Another way of filling drains of this shape is to set flat stones, or those with thick ends and thin ones, on the bottom, with the smallest and thinnest ends down, leaning against the side stones, and against each other; then put the largest you have next on top which will leave the greater space for water to circulate among those which are on the bottom; a little practice will make all familiar; then finish filling as before directed.

DISEASE IN POTATOES.

BY M. SUTTER.

According to the last census, 108,298,060 bushels of potatoes were raised in the United States. Unfortunately, within the last two years, this crop—of importance inferior in this country to none, except *perhaps* the wheat crop—has suffered severely from disease. What the average diminution from this cause may be through the nation, it is impossible to estimate from any data in my possession. In some sections, however, it may safely be set down at fifty per cent, and in others as high as, or higher, than seventy-five per cent. Some individual cases may have occurred, where the

crop has been a total loss. The failure of such an article, which has formed the chief dependence of the poorer classes for food, is calculated to excite intense alarm, and the investigation of the cause of the disease, and some remedy for it, becomes a subject of the highest importance. It is not my intention to offer any thing as to its nature or cause, for notwithstanding all that has been written upon it, I regard it, as yet, utterly in the dark. The surmises in regard to the disease, afford a striking example of the too great tendency in our farmers to frame theories, without sufficient ground. Instead of collecting facts, and making extensive observations, and then comparing them, the discovery of every new fact and sometimes a *false fact*, has given rise to an explanation which has seemed entirely satisfactory to the mind of the individual who has noticed it, but unfortunately to no one else. I do not say this is true in all cases, for there are some which may approach to the truth. But I must be pardoned if I bestow upon others all the ridicule with the pen, which I have upon reading them. I shall, in what follows, endeavor to state the individual conjectures about the origin of this disease, and some reason for not giving full belief to them.

1. *Chemical defect*—either in the soil or in the tuber, produces a tendency to decay.
2. *Unfavorable weather*—occurring about the time the tuber was forming.
3. *An insect*—injuring the root—directly, or by its ravages in the stem.
4. *Honey-dew*—a substance about which nothing is known.
5. *Improper care*—in keeping the root through the winter.
6. *Manuring in the hill.*
7. *Manuring the land.*
8. *Atmospheric causes.*
9. *Fungus.*
10. *Degeneracy in varieties*—from long cultivation.
11. *Degeneracy in varieties*—from propagating by seed.

This is a full list, so far as I have seen or heard of suppositions upon the subject. I will now proceed to state them more fully.

1. *Chemical defect.* It is very natural for a chemist to suppose this to be the case at first view; but when it is remembered that there is hardly any portion of world where the potatoe is culti-

vated and the disease has not prevailed—that all soils have been alike liable to it, and that portions of the crop may be found perfectly sound even in the same hill where others decay, it cannot be decided that this is the cause. And if it does not result from defect in the soil, it cannot be supposed to be so in the tubers. As will appear hereafter, plants growing side by side may be one bad and the other sound.

2. *Unfavorable weather*. In the summer of 1843 a long and severe drought occurred, followed by heavy rains and continued hot weather. Just at this time the disease was first noticed in this country. Of course the weather was universally set down as the cause, and the trouble was not looked for again. But in 1844, a season totally different from the former, it occurred to a greater extent than before, and this could no longer be regarded as a sufficient reason.

3. *An insect, or worm*. I was inclined to pass over this as utterly undeserving notice, farther than mere mention. But I have concluded to insert some clippings from a few papers, showing up the notion. The "Massachusetts Cataract" contains a communication from Henry M. Paine, on the subject. He states that he has examined the diseased potatoes with a microscope magnifying nine thousand times. He found an insect near the juncture of the stalk and root, with "a body shaped like the soldier ant, and legs like the hairy garden spider."

The editor of the "Newsletter," Westfield, Mass., says the disease is not owing to an epidemic influence operating as a disease, &c., but to an insect that has made it a nidus for the perpetuation of its species." He says farther, that from some of the infected potatoes "may be seen the insect in its pupa state, escaping; in others, you may, on boiling, find the rudiment of the insect in embryo: and in others, no insect will be found, they having escaped into the ground."

A writer in the "Washington Post," Salem, N. Y., says, after describing the appearance of the disease, "The perforations in the skin appear to be made by the different kinds of worms. The most numerous are about half an inch in length, of a brown color, body oval when full size. The other is a small brown worm, body round, and the size of pin wire, an inch in length; on the potatoes are small white spots, resembling potatoe starch, which I at first

mistook for mould, but proved to be the castings of these destructive borers."

The following is from the "Massachusetts Spy:"

"In connection with all its stages, except its most advanced decay, but more especially in its incipient attacks, are found *maggots* or *larvæ*, and other creatures which I shall call *insects;* and even in the most decayed specimens, there are, apparently, traces of their mischievous work. The larvæ or worms average about a line in length—are slender, with dark heads, semi-transparent bodies, and are sluggish in their movements.

"The insects are, some, invisible to the naked eye, others, a mere visible white point—and others still, nearly a line in length, with numerous short legs, long antennæ, of a white color, extremely active and shy."

And this from the "Utica Daily Gazette:"

"They bear the appearance of having been eaten out by an insect, and in many cases I discovered a small green colored maggot in the cavity. On scraping off the outer bark from the vine I discovered that the leaflet buds had the appearance of having been eaten out, leaving the holes through which I conjectured the insect had passed. Those vines attached to a sound and ripe potatoe were solid and partially green. Is it not possible, and highly probable, that all this evil may thus be caused by an insect?"

These are a few, from the legion I have met with on this point. But it is far more probable that the insects, worms, &c., are attracted by the disease, than that they are the cause of it. When I planted my potatoes last spring, as soon as the puces touched the ground, I observed that they were covered with a little black insect, which all hopped off suddenly when disturbed. Perhaps they deposited the egg to produce the disease.

4. *Honey-dew.* I have noticed a great deal of late in agricultural papers about this substance, but without finding out what it is, and now it is lugged in to account for the potatoe disease. This substance has been seen on the *vines*, and perhaps it caused the tubers to rot. Well—*perhaps* it did.

5. *Improper care in keeping the tuber through the winter.* This is an imported opinion, and worth just about as much as Yankee ones. It supposes that the tubers are stored in heaps and thus become heated, producing weakness. But they have always

been stored in this way as long as I can recollect, and if this would have injured them, it ought to have done so years ago. But I aver, that if there is vitality enough in the eye of a potatoe to sprout and to reach the surface of the ground, this cause cannot operate. The new roots are sent out from the bottom of the new shoot immediately after it starts, and then draw nourishment from the ground. These shoots may be entirely separated from the old potatoe and planted, and will produce a good crop.

6. *Manuring in the hill*; and 7. *Manuring the land*. These amount to one and the same thing. It has been observed, in some cases, that where manure has been freshly applied, the disease has been worse than where none had been used. A writer in the "Newburgh Telegraph," says:

"We planted a small patch of potatoes upon a very heavy soil, turned over a few weeks before planting. From this we had twelve bushels, about half of which turned out bad. In an old garden, separated from this by a fence, where no manure was applied last year, and, as far as we can ascertain, for two or three years, we gathered sixteen bushels, not one of which was bad. The latter, however, it might be mentioned, were planted earliest."

And further, that a farmer in that county stated, that in the same field, where it was manured, the crop was an entire loss, while in a portion that had no manure, the crop was good. A writer from Columbia county, in the same paper, states his experience as the same.

8. *Atmospheric causes*. The following from the Amherst Express, suggests this opinion.

"I strongly suspect that the strange disease, which for several years has so deeply affected the sycamore, plane, or buttonwood tree, (*Platanus occidentalis*,) is analogous to that which has now assailed the potatoe. I was struck with the resemblance, when cut open, between a partially decayed branch of the sycamore, and a potatoe in the same state. I do not believe that in either case the disease results from parasitic plants or insects : two fruitful sources of disease to plants. Why may it not be some atmospheric agency, too subtile for the cognizance of our senses, like those which bring such epidemics as the influenza and the cholera over particular districts or continents? Modern science has shown us that many of the most powerful agencies of nature are concealed from

common and even acute observation. May there not be others yet undiscovered, which deeply affect the delicate machinery of organic life ?"

9. *Fungus.* I cannot do better on this point than present the curious and interesting communications of Mr. Teschemacher, of Boston, unless they occupy too much space. It is the only examination conducted scientifically which I have seen. They are taken from the "New England Farmer."

NUMBER ONE.

MR. BRECK—Mr. James Brown having kindly brought me some of the potatoes infested with the disease which has this year committed such ravages on this vegetable, I proceeded at once to investigate the subject.

The peculiar smell, and the reputed poisonous qualities of this diseased potatoe, made me nearly certain that it was a species of fungus—a position which I think has been confirmed by my examination with the microscope.

The appearances which I examined were—

1st. A nearly black discoloration of the potatoe, just below the skin, penetrating about one-sixteenth to one-quarter of an inch into the substance, and apparently through the skin, in little black, indented tumifications, like pustules. It is probable that in these holes the vegetation of the fungus first begins, and spreads underneath.

2d. On the surface of the skin, where these pustules were enlarged, there had been produced a greyish, slimy substance, of a very offensive smell.

The black mass, divided in a drop of distilled water, exhibited under the microscope a number of long and oval, very irregularly shaped dark bodies, interspersed among the cells of the potatoe. Many of these cells appeared lacerated, but this might partly have been produced by the mechanical action of dividing, although I think not altogether. The greyish slimy mass was semi-transparent and indistinct, even mixed with distilled water, and exposed to the strongest light I could throw.

In order to discover a remedy for this disease, I decided on applying various substances to this fungus, with a view of effecting its decomposition, and examining their action under a microscope.

The first application was salt, and the action of this was so instantaneous and decided, that I did not proceed to any other.

A portion of the dark substance was placed on a piece of glass, on the microscope-stand, in a drop of distilled water, and then thoroughly examined. A little salt, on the fine point of a penknife, was then added; a nearly instantaneous change took place —the dark-colored masses separated, much of them seemed to pass away, and instead appeared numerous dark slate-colored bodies, which I easily recognized as the spores, or reproducing bodies of the fungus. With the grey, slimy substance, the effect was still more striking: all the indistinct slime disappeared—the mass became clear and transparent, and left nothing but these innumerable dark globules floating about in the drop of water.

It seemed to me, that the salt destroyed all the vegetation of the fungus, leaving nothing but the reproducing spores, which are indestructible by salt. The spores of fungi are the bodies by which they are reproduced and spread, and are analogous to the seeds of other vegetables, and these spores are generated in such enormous quantities, that many fungi, like this on the potatoe, spread with inconceivable rapidity; but in order to vegetate, they require certain favorable conditions and circumstances, which yet require much investigation. These favorable circumstances are, in my opinion, prevented by salt, as it destroys the fungus vegetation. Therefore, wherever the disease existed this year, I recommend a liberal supply of salt to be spread on the soil, and trust it will eradicate the evil. It is, at all events, a remedy which cannot do much injury, if it does not succeed.

During the examination of the black substance, I of course recognized the grains of starch, which appeared sound; but wishing to know whether the fungus had affected them, I added a little iodine. The grains immediately took the usual purple color, and I think were not at all injured; indeed, it appears to me, that the injury takes place by the rupture of the cellular parts of the potatoe.

I am aware that it requires some practice to judge well of the appearances under the microscope; but I repeated these examinations six or seven times, and always with the same results: still, I should be very glad to have them repeated by others, whether their correctness be confirmed or not.

My microscope being made by myself, is of course very inferior to those now manufactured in London and Paris; and it would be very desirable that some of our scientific societies would import one of these, the cost of which is too high for persons of moderate incomes. It might be made accessible, under certain conditions, to those desirous of undertaking such investigations as these; for there are many cases where the action of various substances on the causes of animal and vegetable disease are examined to very great advantage under the microscope, and effects seen which cannot be observed in any other way.

Should any gentleman, possessed of one of these superior instruments, be desirous of examining this disease, I would request of him to look at the action of the sulphate of iron, sulphate of soda, or of ammonia, or of any other substance which can be cheaply applied to the soil as a preventive, and to give notice of his observations either in your or some other periodical, for I see with delight anything that can bring nearer to each other science and agriculture. Yours,

J. E. Teschemacher.

Boston, Oct. 1844.

NUMBER TWO.

To the Editor of the N. E. Farmer—

Not having seen any communication objecting to the views I have taken of the cause of the disease in the potatoe, and which subsequent examinations have only tended to confirm in my own mind, I resumed the investigation of the subject. The results I now offer to you for publication. I have first to notice the idea that this disease arises from worms which are found in the decayed potatoe—and remark,

1st. That the worms are the same which are found in all rotten potatoes, from whatever cause the decay may arise.

2d. The potatoe decays previous to the worms appearing, for the worms are never found in the sound part of the potatoe, eating their way in or depositing their eggs, nor have I ever seen the worms in that part of the potatoe in which the fungus has already commenced vegetating: it is only in the most rotten part that the worms exist, after the fungus has caused this decay.

3d. Salt instantly kills the worms, as any one may satisfy himself, with the assistance of the common compound microscope.

Under the full impression of the existence of the fungus in the potatoe, two questions present themselves.

1st. Is the fungus the cause of the decay, or merely a growth on the tuber already diseased from some other cause ?—and

2d. When and in what part of the plant the disease originates, and how it is propagated and disseminated ?

The probability is that the fungus is the cause of the disease—for the fungus appears on the skin of the potatoe, and can be traced by its gradually dark color penetrating from the outside by degrees into the sound inside, the outside fungus developing itself first, and producing slime and rottenness, while the inside yet remains firm and sound. If the fungus resulted from the potatoe first becoming rotten, and thus forming favorable circumstances for its vegetation, then the presumption is that we should occasionally, although perhaps rarely, find parts of the potatoe rotten *without* the fungus, which I, at least, have never yet seen. I have often seen heaps of rotten potatoes, without ever before observing this peculiar fungus, which, on account of its smell, cannot be mistaken. If this was therefore a disease merely affecting the rotten potatoe, and not the sound one, it would have been long ago and much more often observed. Dr. Wallroth, an excellent German botanist, who appears to have closely studied the fungus family, observes in the *Linnea*, (a botanical periodical, published in Germany,) Vol. XVI. for 1842, that he has ascertained the disease called there the *potatoe scab*, or *wart*—a kind of swelling or tumor, ending in rottenness—to be a species of subterranean fungus, which he calls *Erysibe subterranea*, and of which he gives a long scientific description. I am not sufficiently versed in this subject, to decide whether this description agrees exactly with the disease at present under discussion, but it appears to me to differ in several particulars.

The second question, as to the origin and propagation of this fungus, is one which presents great difficulties in its solution. These arise partly from the knowledge of the propagation of the fungus family being yet in its infancy, and partly from the want of means of pursuing the study of this microscopic subject properly. From the almost universal accounts of the tops of the plants hav-

ing first died down, and thus indicated the disease, it has suggested itself to me, even if this fungus is really a subterranean species, whether it has not been propagated and disseminated by spores floating in the atmosphere and attaching themselves to the *stalk* of the potatoe, on that vegetating and extending themselves downwards until they reached the point of junction with the tuber, there producing decay, and the death of the upper part of the vegetable, and afterwards disseminating themselves through the tuber.

A parallel to this probably exists in the *mushroom*, a fungus which is naturally produced from horse droppings, when by being kept dry for a considerable time, they have arrived at a favorable state for the development of the spores. These spores have probably attached themselves to the stems of hay which has been eaten by the horse, have passed through its stomach and remained in an inert state, until favorable circumstances have produced their development in the droppings.

I regret that I had not commenced this investigation early enough to have examined the stalk and its junction with the tuber, with the microscope, on the first appearance of its drooping, as all the proof now to be expected from experiments, can only be of a negative character: however, here are such results as I have obtained:

1st. One of these much diseased potatoes was cut in halves; each half was placed on half a sound potatoe, in perfect contact, placed under a bell glass in a damp, dark atmosphere, temperature 57° to 62°. In five days the sound potatoe was not in the slightest degree contaminated with the fungus or the worms.

2d. A whole diseased potatoe covered with black spots, was placed under a glass, in the same circumstances as experiment No. 1, in contact with a whole sound potatoe. The fifth day the sound potatoe remained uncontaminated and without worms.

3d. A whole and much diseased potatoe was buried two inches below the soil, which was damp but not wet. A sound potatoe was buried in the same soil, two and a half inches distant from it, the temperature kept as before—57° to 62°. In five days this latter remained quite sound.

It is possible that five days is not long enough; I have therefore left them all in the same state, and shall not touch them for three or four weeks.

As I do not seek to establish any favorite theory, I trust my remarks may incite to observation and provoke discussion, and provided the practical and useful truth on this subject be discovered, I do not care much whether it be by myself or by others.

J. E. Teschemacher.

10. *Degeneracy in varieties from long cultivation.* Some have thought that some varieties were less subject to the disease than others. A writer in the "*Democrat,*" Northampton, Mass., says: "We have a field of 'Mercers' that have nearly all rotted, while 'Carters' adjoining appear *much less injured.*" But on the other hand, the writer in the Amherst Express, already quoted, says: "The 'Carter' potatoe is the *most decayed.*" Indeed, no variety seems to have been exempt. If the disease is owing to degeneracy of this kind, a very ready remedy suggests itself, viz: to raise new varieties from seed. But new ones have suffered as well as old.

11. *Degeneracy in varieties, from propagating by seed.* This has just been suggested by a scientific friend at my elbow, and differs from No. 10. Every one at all acquainted with the laws of breeding animals knows that too close breeding, or breeding *in and in,* has a tendency to produce effeminate, weakly kind. It is not only so among animals, but the same is the fact in the human race. This theory supposes that it holds also among plants, and that the disease supervenes from the varieties having become degenerated—from raising successive generations from one family by seed. Another friend suggests its analogy to scrofula in man. The former of these, I confess, strikes me as the most probable theory I have yet heard. But it is attended with difficulties like all the rest. If this be the true cause, or either of them, I see no hope for the potatoe, inasmuch as an unhealthy plant must extend a disease resulting from such a cause to all that are raised from it even by seed. We must then go back to the original stock from the mountains of Chili and Peru. This I believe is the sum of the prevailing theories; and as we said before, they all leave us in the dark yet, and we must expect to be there till some more systematic observations are made throughout the country by cultivators. The chemist cannot tell what it is by analysis, any more than he could detect the cause of the small pox by analysing the body of a man that has died with it. Intelligent, observing far-

mers, who are not ready to frame a theory from one isolated fact, are the persons to whom we must look to find out the cause. It has been said that the disease was imported from Europe to this country. If so, perhaps it was brought over for us to detect the cause, and cure it and send it back.

The only remedy we have seen recommended as proving effectual, is a small quantity of lime thrown into the hill.

Wampanuxet, Dec. 19, 1844.

FARMER'S CLUBS.

During the long evenings of winter, the farmer may find much time for mental improvement. We have often thought how much time is wasted that might be used in profitable cultivation of the mind. If every evening were employed in examining and learning one new idea only, it would amount in one year to three hundred and sixty-five—and that is more new ideas than will often be found in a whole book; or in the active years of a man's life, from five years old to fifty-five, he could number no less than 18,250 new ideas; and this supposing he learns only one a day. But when it is remembered that one thought is the father of a multitude, and the more the mind knows the more its capacity is increased, we may take it as settled, that in the ordinary days of a man's life, an amount of knowledge beyond computation may be acquired if only our leisure time is profitably occupied alone. But by interchanging our ideas with each other, we are furnished with another aid in acquiring knowledge.

There is probably no one way in which so much has been done for the improvement of farming, as by farmer's clubs. Wherever they have been established in this country, they have given a new life and interest to the business. But in Great Britain they are laying the foundation of a total revolution in the condition of the tillers of the soil. An idea is generally prevalent, that in that island the large landlords are the persons who take the lead in these meetings. To a degree this is true. Yet, if any one will read the foreign Agricultural Journals, he will see that the tenantry are

also wide awake to the benefits derived from these social meetings, and that in many of them they are the active members. And they not only talk of mere practical matters, but unlike our farmers, they are not startled at the technical words and terms, but grapple with the hard names of chemistry, like men of science, so that it is sometimes highly amusing to witness their familiarity with these matters, though they never saw the inside of a laboratory in their life. But they have learned by hearing others, and they talk understandingly. We know that farmers in this country, that boasts of its general knowledge and education, are apt to ridicule such notions and complain that men who write for their benefit will not find some other words for the names of things they write about, that they can understand, as if oxygen or hydrogen would be any more comprehensible with another name.

But if they will meet together and make themselves familiar with these things, they will cease their complaints. In their meetings they can talk over those matters in which they are all interested, and we venture to say there is no neighborhood in which *some one* will not be found who can explain all hard words.

We have among our own best friends, some farmers, who can talk like a book, as the saying goes, and communicate facts of vast importance and interest, and who, if they would form such associations amongst their neighbors, would aid not a little in stirring them up to improvement. Ideas which one man may think of little consequence, because he has known them all his life, may be entirely new and of great benefit to others. And there is no man who has not something in his head that will be new to somebody. The march of the world is forward now, and there is no class of men who have suffered so much undeserved neglect as the tillers of the soil. They need, as a mass, a strong lift to bring them up. And we rejoice at every aid that is held out to them. Let them be induced to form clubs—meet together sociably, and talk over what they have done and are doing, and what more can be done by them—learn what peculiarities of tillage each one may have, and if they are not able at first to talk very learnedly, we venture to say that the sense of their ignorance thus brought home to them, will stimulate them to seek for information where it can be found. It will open the way for knowledge to creep in, and they will be better prepared to become scientific men.

The idea of *book farming*, seems to be lawfully repugnant to some men ; but book farming is only the filling up of the very practices which every man has followed, who ever drove a plough through the soil, or carted a load of manure upon it. That it does reprobate, and most deservedly, the murderous practices which have almost made deserts of some of the finest and most productive parts of our country, is most true. But it teaches also the methods to be pursued in order to renovate the exhausted land and make it once more a garden.

We have escaped from our subject—but let us go on a little farther. What has been the cause of this ruinous system ? We believe in many cases it is the fear of expense. Many men will not take the trouble to estimate the additional gain which would accrue to them from restoring to their soil, a portion at least, of what they have taken away. The prospect of a small gain, quite hides the view of a great gain, preceded by a trifling outlay, and so they content themselves, looking upon their farms growing poorer every year, but we venture to say, no faster than they are.

Another class is really ignorant of what ought to be done. We cannot easily forget the surprise of a farmer, who calls upon us very often, when, in talking to him about the use of *urine*, as a manure, a few days since, we told him its value and how he might save it by the use of charcoal ; and he burns charcoal on his own farm. He opened his eyes upon a new fact, and went away exclaiming : "I'll try it ! I'll try it !"

Now to return, for we do not wish to speak of that class of farmers who are too lazy to till their land properly. In these agricultural meetings, a thousand facts would be circulated ; what one man reads will be told to those who do not and will not, and in this way, before they know it, they will be as much book farmers as any. We are all creatures of imitation, and one man will do what he has seen his neighbor do with success. And knowledge is catching, when there is any in circulation, even by the most indifferent. Let our friends in the country try the experiment, and see if it does not succeed.

PLOUGING.

NEXT to the free manuring of the soil, nothing is of more importance in agriculture than ploughing. Indeed, it may be said to rank before manures, inasmuch as their application can be of little service, unless the ground is prepared to receive them, by means of the plough. It is not our intention here to say anything of the mechanical part of this process, but simply to set forth some of the principles upon which its use depends.

It pulverizes the soil. Every one knows the benefits arising from this process. A free access is given to the air, and the gases which are always floating in it. The carbonic acid and ammonia which we have often spoken of as the essential food of plants, circulate through all the soil, and are equally distributed to the roots of plants. These, unobstructed, can also extend themselves farther in all directions, and find an abundant supply of nutriment.

The access of the air also assists in the decay of any vegetable or animal matter which the soil may contain. This, whilst the air is excluded, lies inactive, or is converted into substances which are injurious. But by the action of the oxygen of the air, a thorough decomposition takes place, and the elements of the plants are restored to the soil to become the food of a new race. Besides this, there are certain compounds of the metals with oxygen; which in one form, are active poisons to all vegetable life. This is where they are united with only one portion of the oxygen, but when they are combined with more, the effect is different. Now, when the admission of air is not free, the decaying substances in the soil take away the oxygen from these higher forms of combination and leave one which is injurious. Some of the salts of the metals are produced in the same way, which destroy vegetation.

The action of the air upon the inorganic parts of the soil, is not less worthy of notice. All soils contain portions of rocks, in an undecomposed state, which consist of elements of great fertility. By ploughing, these are turned up to the air and thus exposed to decay more or less rapidly; restoring the very elements which may have been exhausted by previous cropping.

The germination of seeds is aided by pulverizing the soil. For

this process to take place, the presence of oxygen is necessary. Now, seeds buried deep in the ground, or even at a slight depth, and surrounded by compact earth, cannot grow. This is always found to be the case in ploughing land that has been laid down to grass. New kinds of plants will start up in abundance, and seeds, no doubt, may lie buried in the soil for many years in an inactive state, merely for the want of air.

There are numerous other benefits arising from ploughing. It drains the surface of superfluous water, and on the other hand counteracts the effects of drought, by assisting the moisture to ascend from below. If done in the fall, it kills the larvæ of insects, which have been laid in the ground to winter, and also buries the seeds of many weeds too deep to germinate.

But ploughing as done in this country, is only turning over the surface. *Deep ploughing* is rarely practised. And we have often heard men mistake it for *subsoiling*. But the latter process consists only in stirring up the subsoil with a plough constructed for the purpose, without bringing any of it to the surface; whereas in deep ploughing the lower portions of the soil are all brought to the surface, or mixed with the surface soil. There are benefits resulting from this when practised right.

It is a fact, perfectly plain to any one, that the rain falling upon the soil and passing through it, must, gradually at least, dissolve all the soluble substances it meets with, and carry them down to a greater or less depth into the earth. And not these only, but those substances which are not already soluble, but which are in a finely divided state, will be washed down in the same manner. We may suppose that, in this way alone, a surface soil, when nothing is applied, may from year to year be drained of its most valuable parts, and at the same time an accumulation of them take place at a depth below what the plough ordinarily reaches. Under these circumstances, the under soil will contain the elements of great fertility, whilst the surface soil may be very unproductive. It will readily occur to any one, that in such a case the proper course will be to plough deep—to turn up this under soil and make it the top soil. This is undoubtedly true. The fact is, that the plough is very rarely carried to any considerable depth—from four to six inches being probably as deep as almost any farmer ploughs. Hence the soil below this will be constantly becoming richer,

whilst the surface becomes poor. Now, if the plough were to be carried from six to twelve inches deep, this fertile portion would be brought to the top and furnish a new soil.

That this is correct in principle, there can be no doubt. Yet caution is necessary in putting it into practice. Those substances which are valuable as food for plants are not the only ones which sink down through the soil. Many will be found which are actually injurious, and which, if brought to the surface, would destroy all hope of a crop. The solid state of the under soil prevents also the free access of the atmosphere, and therefore this soil will not have undergone that thorough decomposition which is necessary to fit it to be productive. Deep ploughing should therefore be done either

I. Gradually. Year after year the plough may be driven deeper, bringing up and mixing with the surface soil the lower portions, which will thus, without material injury, be gradually incorporated and form a deep soil. This will probably be found the best course, as there is little risk in it of doing injury to the present soil by mixing too large a quantity of noxious substances with it. Or,

II. There are many soils where, if deep ploughing is practised in the fall and the lower portions exposed to the winter's freezing, they will be so broken up and changed, as to be ready for a crop in the following spring. In this case, the land should again be ploughed crosswise in the spring, so that the old and new soils may be thoroughly mixed together. By this means also, the destruction of many injurious insects whose larvæ have buried themselves beneath the reach of ordinary ploughing, is insured. The more thorough the draining of the soil, and the chance given to the roots of plants to extend themselves deeper, are important advantages connected with this process. Farmers generally do not seem to appreciate the fact, that plants are highly organized beings, deriving their food by their roots, from the soil, and, of course, growing perfect in proportion as they have a better opportunity to supply themselves by reaching out their fibres in all directions.

Where the lower portions of the soil contain such substances as are injurious, and which cannot be mixed directly with the upper, thorough draining should be practised; and this, together with the use of the subsoil plough, will, after a sufficient time, prepare the way for deep ploughing.

GARDENING—LIQUID MANURES.

The paramount importance of giving to growing plants an abundant supply of manure, cannot be too deeply impressed upon the mind. Many persons use it as if they feared its effects and were going into a very careful experiment to ascertain whether or no it may not do hurt; whereas it is a fact that every one ought to know, that a plant cannot reach any thing like perfection without it. We have heretofore given a full list of the kinds of manures most commonly used in this country, and the modes of preparing and applying them. We wish now to call the attention of those engaged in horticultural operations to the use of *liquid manures.*

The constitution of plants is such that they can receive no food except that which is dissolved in water. In itself, water is probably of very little use to them. They could easily obtain the elements which compose it, and which it affords to them, from numerous other sources; but as a solvent to prepare nourishment for them, it performs a very important office. The extremities of the roots consist of a loose, spongy structure, covered with a thin sort of membrane, pierced with numberless small holes which are the terminations of the sap vessels. These are essentially the mouths of plants, and through these they imbibe all their food. Of course they can only take up that which is immediately in contact with them, and when this is exhausted, they extend their fibres in quest of more.

Again—the slow decomposition which takes place underneath the surface of the ground, by which manures are rendered soluble, furnishes a very small portion of food at a time to plants. The supply is constant, it is true, from this source, but it is scattered through the soil, and the roots must either extend themselves to find it, or depend upon the circulation of moisture in the ground to bring it to their mouths. The former is a slow process, and the latter often a very precarious one; so that, in dry seasons, the products of the garden may be very much shortened, or even cut off, for want of water.

We believe that liquid manures might be very extensively and economically used, in the large way in agriculture. But we intend these remarks to apply particularly to gardening, where the

sphere of operations is not so large as to make the process look formidable. The benefits arising from this mode of application may readily be inferred from what has been said. The manure is applied in a form ready to be immediately taken up by the plant—it may without trouble, be made of any strength—and it is applied directly to the roots. A correspondent of the London Gardener's Magazine, speaking of the cultivation of the ground at Ghent, says:—"Liquid manures may justly be considered the summum bonum, as, if applied when the corn is sprouting, or just before a rain, it has an effect which no other manure can have. It destroys insects and throws a surprising degree of vigor into the crops." The Chinese, who are said to excel all other nations in the knowledge of gardening, make a very extensive use of this practice, thus manuring the plants rather than the soil, and by this economy are enabled to produce large crops with their limited quantity of manures.

When writing at large on the subject of manures, we noticed a kind of liquid manure recommended by Dr. Dana, of Lowell, amounting to this—to one hundred pounds of peat, add one pound of potash and fifty gallons of water, in any convenient vessel, and stir the mixture occasionally for a few days, when the liquid may be drawn off and applied to the roots of plants. The vessel may be repeatedly filled and used again.

Any of the kinds of manure commonly used may be stirred up in water, and after having stood for a sufficient time to extract the soluble matters, applied in the same manner. Urine, made very weak with water, would be a very useful application to vegetables two or three times in the season.

ADAPTATIONS OF NATURE.

The insect tribes, and the vegetable kingdom, march on harmoniously together under the genial influence of the sun, which warms both into life at those periods to which both are adapted; if one is retarded by the absence of the necessary temperature, the other is also immature and undeveloped, and thus waits for the favorable condition in which it may securely and with certainty fulfil the law of its being.

GERMINATION OF SEEDS.

Three circumstances are necessary in order to fit a seed to germinate, viz: heat, moisture and air. If either of these are wanting, the process of vegetation will not go on. No seed will germinate at a temperature below the freezing point of water, and as a general thing not less than ten degrees above that point. About forty degrees of Farenheit's thermometer is the lowest, and above that to eighty degrees—the temperature varying according to the character of the seed, whether it be of a plant belonging naturally in the hot, warm, or cold regions of the earth. Some seeds will bear a greater degree of cold than others, without losing their power of germinating. The severest cold of our winters leaves them uninjured, whilst others perish.

Moisture is also necessary. Not a great quantity of wet, but so much as the earth will naturally hold. Too much water is injurious; the effect of it may be seen, if any one will put a pint of peas in a bowl and fill it to the top of the peas with water; after they have been left two or three days, those on the top will be found to have sprouted, whilst the lower ones are only swelled, and in a few days these latter will be found to have rotted without having begun to grow. With many seeds the process of germination is materially hastened by soaking in water or the solution of some salt. Boiling water may in some cases be used, and there are seeds which will not lose their power of growing even by being boiled for one or two minutes. A better plan than to immerse them in water, when the quantity is not large, is to wrap them in a wet cloth and place it in a damp and dark place till germination commences. Soaking in soot water, tar water, and in solutions of salts, has been supposed to prevent rust and other diseases to which grain is subject, and also to prevent the depredations of insects. This, we apprehend, is not the case. The only benefit we can recognise as arising from it is a rapid growth, produced by the stimulating and nourishing properties of the substances used, which enables the plant to reach a size too great to be injured before the insects are produced. We know of no well

authenticated experiments which show its effects in preventing rust or other diseases. If such is the case, it arises probably from the same cause—the rapid and healthy growth of the plant.

Seeds will not germinate if air is excluded. The oxygen is absolutely necessary to produce those chemical changes which take place in a growing plant. Hence seeds which are buried deep in the earth may remain for years in a sound state and yet not grow, because they are out of the reach of the air. Facts of this kind are familiar to every one. When a well or pit is dug, plants often spring up of kinds which have not been seen in the same region before. They have retained their power of germinating for years, and as soon as they are brought under the proper influences this process takes place. This shows that seeds should not be planted too deep, and indeed experiment has fully shown that seeds planted not over one-half inch below the surface will grow quickest.

Light has also an effect to retard germination. One change which takes place during the process, is the formation of carbonic acid, by the carbon of the seed uniting with the oxygen of the air. Now the well known effect of light is to cause plants to retain the carbon and set the oxygen free, and the effect is probably the same upon seeds. While exposed to the light, there is the struggle between the opposing principles, and germination is slow to begin. But in darkness the carbon is separated, and that action which is called life commences.

Amongst other uses to which charcoal may be put in horticultural operations, may be mentioned, that it hastens the germination of seeds. If they are sown in pure charcoal, or in earth which is largely mixed with that substance pulverized, they will be found to sprout and send up their first leaves several days in advance of those sown in earth only. At least this is our own experience, and it is our opinion that seeds which have been kept so long as to lose their power of growing, under ordinary circumstances, may be revived by the use of this substance. Whether seeds may be said to be *alive*, is to us a question. We know of no form of life in organized beings unattended with specific action. We are inclined to think that life is developed in them by the circumstances mentioned above.

CHARCOAL—ITS PROPERTIES AND USES.

This substance has excited great attention of late in some portions of the country, although no accurate experiments have yet been made to test its value as a manure. In theory, it is certain that it possesses properties which are calculated to render it a very valuable substance in agriculture. And this arises from a power not peculiar to charcoal. All porous bodies have the property of absorbing the different gases in greater or less quantities. Charcoal, *after it has been heated to redness, and cooled without being exposed to the air*, will absorb ninety times its own volume of ammoniacal gas, and considerable quantities of others. If heated and cooled under water, and then placed in a confined portion of atmospheric air, it will absorb all the oxygen and leave pure nitrogen. Now, upon this property of absorbing gases depends its use as a manure. In itself, it has no valuable properties. It is one of the most indestructible of substances. Exposed to heat of the greatest intensity, if air is excluded, it suffers no change. Moisture has no effect upon it, and there is no chemical agent which will act upon it. It has been said by some writer, that, after being in the ground for several years, it becomes converted into a sort of coaly earth. But, on the other hand, it is a well known fact that fence posts are often charred at the bottom, in order to preserve them from rotting, and it succeeds for a great number of years. In this case, no such change can have taken place. It is, at any rate, very doubtful if it is ever converted into earth, or, of itself, furnishes any food for plants. But it does absorb gases, and by the powerful condensing force which all porous bodies possess, they are made solid in the pores of charcoal. One cubic inch of charcoal will condense ninety cubic inches of ammonia, or thirty-five of carbonic acid. And, holding it with all this force, how are they to give it off to plants? One class of theorists will say, that the vital power of the plant can separate it. But it is locked up in the pores of the charcoal, where not even the most minute fibre of the roots can penetrate. Others say, it is by the power of fixing gases that it does good, but they do not account for the giving them out. What then is it? Let us look a moment at another fact.

Water absorbs, at the common temperature and pressure, from seven hundred to eight hundred times its volume of ammoniacal gas, and when boiled will not part with the whole of it. Now notice the difference: charcoal absorbs ninety, and water eight hundred times their volume. The superior force of the water is seen at a glance. And what must be the result? Why, simply this: If charcoal is put upon land as a manure, however much gas it may have in its pores, the first shower of rain will separate it and carry it with it into the earth, ready for the use of the plants. In the mean time, the water takes the place of the gas in the pores. As soon as they become dry, and perhaps before, the process of absorption commences again, and again it is washed out.

This view of the case would indicate the use of charcoal as a top dressing to crops. And this we believe to be the correct plan. Buried in the soil, it adds to its looseness, but is not exposed to alternate dry and wet, as when on or near the surface.

But its action in compost heaps, or as an absorbent of the urine of man and animals, depends upon another principle. The general opinion seems to be, that its use is to absorb the gases, ammonia, &c., which are given off during decomposition of animal and vegetable substances. That this is not the case will readily appear, if any one will reflect a moment upon its well known action on animal matter. If meat which has begun to putrefy be packed down in charcoal, it is not only deprived of all bad smell, but the process of putrefaction is immediately stopped. No more gases are formed, and of course none can be absorbed. Its effect in this case is to stop the process of decay. In the same manner, any animal or vegetable substance, if exposed to the action of charcoal may be preserved for any length of time unchanged. What the power is by which this is done we do not pretend to say.

It is not, then, by absorbing gases that it is so useful in these cases, but simply through this power of preventing decay and preserving these matters in their unchanged state. Thus, when used in the compost heap, or when saturated with urine, all the substances it comes in contact with are brought under its influence, and when applied to the soil are gradually separated from it by the rains which fall upon them, and there undergo the decay which fits them to become food for plants.

Charcoal has the property also of preserving vegetable as well

as animal substances from decay. And it is probably on this account that it has been found useful in propagating plants from their cuttings. Many remarkable experiments have been made with it, and with great success. Even leaves have taken root in finely powdered charcoal, kept constantly wet.

INORGANIC PARTS OF PLANTS.—STRAW AS A MANURE.

Besides the four substances which we have often mentioned—oxygen, hydrogen, nitrogen and carbon—as forming what are called the organic elements of plants, a number of others are always found in them, which they derive from the earth; and these have been called *inorganic*. They are all of mineral origin, being produced by the decay of rocks, of which they form a component part. We have said, they were always found in plants, and this is strictly true—they being as absolutely necessary for the production of a perfect plant as those first mentioned. But the quantity is not at all times the same, nor the same in all parts of the plant. Thus, during one period of its growth, one substance, as potash, may be found to abound; whilst, at another period, the relative proportion of this particular substance will be found to have very much diminished. And the whole proportion of inorganic matter may be very different at one period from another. Thus it was found that "plants of the same wheat, which a month before flowering, left 7.9 per cent of ash, left when in flower, only 5.4, and when ripe 3.3 per cent"—(Johnston)—showing a remarkable diminution in the quantity of ash, or rather, perhaps, increase in organic matter.

Different parts of the same plant exhibit, also, a very material difference in the same respect, and presenting a very strong practical bearing to the farmer. We shall refer to this below. The fact is shown by the analysis of the straw and grain of different plants. According to Springel, whose analyses are thought to be very correct, when 1000, lbs. of wheat straw are burned in the open air, 35.18 lbs. of ash are left. When the grain itself is burned, 11.77 lbs. are left. We give some of the most remarkable differences between the quantities of inorganic substances, of which this ash consists, in the following table:

	Grain.		Straw.
Potash,...........	2.25 lbs.	....	0.20 lbs.
Soda, ...	2.40 "	....	0.29 "
Lime,............	0.96 "	....	2.40 "
Silica,............	4.00 "	....	28.70 "
Phosphoric acid,...	0.40 "	....	1.70 "

Here can be seen at a glance, the greater quantity of potash and soda in the grain, whilst the straw abounds in lime, silica and phosphoric acid. The silica, as might be expected, is vastly more abundant in the straw than in the grain, being, in fact, the back bone of the plant, by which it is enabled to bear its burden of grain erect. And experiment has demonstrated that upon whatever soil the plant is grown, if it attains a healthy growth and ripens its seed well, the quantity and quality of the ash is nearly the same.

As we said before, this has a very important practical bearing. It shows the process by which soils become impoverished, and also serves to point out the method by which they may be continued fertile or improved and restored when exhausted. And we have been led to these remarks by having often heard it said, and lately by a highly intelligent farmer, that if the straw was every year restored to the ground from which it was taken, the soil would produce good crops of wheat forever. An examination of the above table speaks a different language from this. The straw and the grain deprive the soil of very different substances. By restoring the straw, the lime, silica and phosphoric acid would be mostly returned, but the potash and soda would be taken away. Thus gradually these would be diminished, and although from year to year little difference might be noticed, yet after a number of years, if the extremes are compared, we do not doubt that a vast change would be discovered. The practice of returning the straw to the land is a good one, but at the same time it will be perceived that other manures, and those containing the substances taken off in the grain, are necessary to keep the soil in a really productive state. And well conducted experiments will determine exactly what those manures should be; and this is one great aim of agricultural science.

We would recommend, in this connection, to all who are engaged in agricultural pursuits, to study the 2d No. of Johnston's Agricultural Chemistry. The whole work is one which should be

in the hands, and its contents in the head, of every farmer. There is not its equal to be found; and, if carefully studied from the beginning, there is no reason why the whole should not be understood. The author has conferred a lasting blessing upon his race.

INJECTION OF WARM WATER INTO THE UTERUS OF THE COW AS A MEANS OF EXPEDITING DELIVERY.

This method of promoting delivery in lingering cases was by Dr. Dick, an eminent veterinary surgeon of Edinburgh. Having been consulted by a person in the neighborhood, whose cow was in great distress with a prospect of an unfavorable issue in her accouchment, six or eight quarts of warm water were injected into the uterus after elevating the animal's hind quarters by a bundle of straw. Within five minutes the calf was safely expelled by the natural efforts. The instrument employed was a common syringe, fitted with a large flexible pipe of gum elastic. The liquor amnii had escaped at an early stage, and the animal had become nearly exhausted. After the water was injected the calf floated in the uterus freely. It is unquestionably an important method, and one which may be resorted to again under similar circumstances, and should be remembered by the person who may have a valuable animal suffering and in danger of losing her life.

NECESSITY OF AIR, MOISTURE AND WARMTH.

For the successful culture of all crops it is necessary that the roots should be supplied with air, moisture and warmth. The condition necessary to supply air and warmth are the same. First, looseness of soil. Second, a proper depth beneath the surface. Whatever may be said of the carbonic acid in the atmosphere, as the food of plants, farmers certainly will not infer from it that it is no matter how the roots are served. As no seed will germinate without air, so plants will not thrive if their roots are deprived of it. Too much moisture in the soil prevents the access of air as perfectly as a dense or compact soil from any other cause. Hence the necessity of providing passages and ways by which water may

pass off. This is as necessary as guano, or any other nitrogenized substance. A wet soil is cold from the evaporation constantly going on at the surface. The moisture which passes into the atmosphere is immediately replaced from the water below rising by capillary attraction to supply its place, and constant circulation is thus preserved from below upwards; even an upward current of moisture goes on in the coldest weather in the winter. Let a pit with water be covered with boards, and the under surface of these boards will be covered with frost during the most severe weather of winter. How much more rapid is the escape of water in warm summer weather than the winter? As the evaporation in one case exceeds the other, so in the same proportion with the temperature.

MEANS FOR IMPROVEMENT.

Could our farmers be induced once a year to visit their brother farmers in their vicinity, it would promote very materially their interests. There are many farmers who sincerely believe that they know quite as much as their neighbors; this, to be sure, may be true, but after all, it is very likely that they are not so well acquainted with some kinds of rural economy as others. Then, again, intercourse with their distant neighbors, for the special purpose of being benefited, will serve more than one purpose—it will benefit both parties, the visiting and the visited. Emulation, which is often the spring of business, will be excited. We do not care who the individual is, or what business he is in, without emulation, without ambition to excel, very little, comparatively, will be done. Farmers, then, visit your neighbors to see how they manage their farms and their stock, and when you have done this, go home and improve upon their modes of management. Beat them, if you can.

OVER RIPENED SEED.

There are many instances where seed for culture, or sowing, is cut before it can be said to be fully ripened. Wheat cut while it is in the milk—maize, too, which from an early frost has not certainly ripened—will grow if cut up immediately and properly dried. In some instances, too, it has been found that unripe potatoes are better for seed, produce a better crop, and more certain, than those which were not raised or dug till they were perfectly ripe. Thus

in the Agricultural Report for 1843, in the Journal of Agriculture, and the Transactions of the Highland and Agricultural Society of Scotland, p. 99, it is stated that the *under ripened seed* of the potatoe crop raised in the bad season of 1841, produced crop without failure in 1842, in the alleged *unfavorable season*, in consequence of heat and drought, while the *over* ripened seed raised in the fair season of 1842, has caused an extensive failure in 1843, in a favorable season. These are very important facts, and as the report very properly inquires, should not unripe seed be planted in all cases?

THE RELATION OF CLAY TO SANDY SOILS.

There seems to be one remarkable association of soils; thus, wherever a sandy tract exists it is rarely disconnected with clay; clay, as such, in this state, underlies every tract of sand which we have seen. It is not always accessible, but in many instances it is so, and it requires only a slight examination to find it. It will frequently be found cropping out beneath the sand in ravines, and on the borders of streams. The Hudson river sands always rest upon clay, and that is the order in which the two deposits are situated with regard to each other, sand above and clay beneath. When clay is the surface material, it is because the superincumbent sand has been removed by diluvial action. From these facts it will be seen, that the both kinds of soils may be frequently ameliorated by mixture, and even is more practicable than most farmers are aware. The position too of these soils is important, on account of the certainty of procuring water; the clay beneath is impervious, in consequence of which it will throw up water when the sand is penetrated.

THEORIES.

Those formulas of belief termed *theories*, which, although they may have been but distant approximations to the true, yet are far more satisfactory than to remain in the mere possession of facts unconnected by expressions signifying the existence of relations. Hence we find in the spirit of philosophy that spirit which attempts

to reduce all facts to order and to express all relations in their simplest forms. All this is eminently observable in the higher intellects, as Newton's, Des Cartes, Hippocrates, Boerhave, Cullen, Linnæus and Cuvier. But philosophy is not limited to a few great and overshadowing intellects, it exists in the human mind. We observe it in that spirit which attempts to systematize all knowledge and all facts. We observe this not only in the astronomer when he attempts to express in general formulas the sum of present knowledge, or to set down the general results of his observations, but also in the mechanic and laborer, where he simplifies his processes and brings under one operation what before required many. If then we find this spirit in man, what high hopes may we not entertain of his advancement, and where shall we limit his attainments or set bounds to his achievements.

EXPERIMENT.

Fishkill Landing, *Nov*. 25, 1844.

My Dear Sir—I tried an experiment on my farm, which, so far as results are concerned, proved highly satisfactory; but the philosophy of the experiment, the true cause of those results is yet to me very questionable. Pray expound : for in agriculture as well as other matters in life, there are more things in heaven and *earth* than are dreamed of in our philosophy.

The lot experimented upon contains thirteen acres of a gravelly loam, which prior to my possession of it, had been exhausted by "*taking every thing off and putting nothing on*," and was foul in the extreme with weeds and stones.

The first year I raised corn and potatoes, manuring in the hill, and obtained of course but a small crop. In the fall I ploughed it again and picked off the stones. The next year I sowed oats, three bushels and three pecks timothy, and one peck clover per acre, lightly top dressed, harrowed three times, and rolled the whole in carefully. The oats yielded thirty-five bushels per acre. In the month of September I thoroughly mixed one ton of plaster and one ton of leached ashes, and sowed it in the thirteen acres as evenly as possible. When winter came on there was a thick coating of vegetable matter on the ground of over three inches in thickness, (the grass had not been pastured or cut) and towards the

close of the winter, (in February,) I sowed forty bushels of powdered charcoal, (or dust, as we call it,) to the acre on the snow. The grass came up early this spring, and last harvest I cut three tons to the acre of handsome and nutricious hay as can be found in the country. Portions of the timothy was four feet high by measurement, and the heads averaged in the highest portions of it eight inches in length. It was cut just after the blossom had covered about two-thirds of the head, and with care the whole was cut and housed without loosing a pound by rotting or bleaching, notwithstanding the continued rains we had last harvest.

Your own investigations and experiments in scientific agriculture, will I presume readily suggest the *modus operandi* of the plaster, ashes and charcoal; but not so with myself. I am still unsatisfied with any solution from books, analogy or practice, but lean more in favor of the potash of the ashes than any thing else —could the charcoal under the circumstances act other than mechanically? Will you favor me with a scientific (practical) solution of my experiment, which I consider not of so much importance "*per se*," as per circumstances of soil, &c.

Very truly your friend,

ROBT. C. RANKIN.

Our correspondent has not given the full account of his experiment and the condition of his land which we wish; but there is but little mystery as it appears to us in the fine crop of hay which was obtained after such a plentiful application of gypsum, ashes and charcoal. The peculiarity in this experiment consists in the application of the charcoal to the snow which then covered the ground. In thus applying it it is very possible that some advantage is gained. Snow, especially fresh fallen snow, is rich in ammonia, and it seems to us highly probable that charcoal may absorb the ammonia freely and store it up for the use of the vegetables. Spent ashes too, it is well known, are well adapted to grass and grain whose straw yields a large amount of silica.

ROAD WASTES.

INTERSECTED as our country is with roads and channels of communication, they furnish a great amount of drained surface which

may be turned to an important end by the farmer whose lands lie adjacent to them. Every rain and every shower washes the road and carries off to parts unknown, the droppings of animals intermixed with the fine earthy materials. Most of these substances now go to waste; even some farmers are so abominably slovenly and wasteful as to milk and yard their cows in the road before their doors and then let the soluble parts run off down the gutter. But even though the waste of roads contained no soluble matter, still the water itself will irrigate the field, and increase the quantity of hay in meadows at least one-fourth their ordinary yield. Let every farmer then who can save the road wastes open shallow drains over his meadows in such a way that the current shall run slow and evenly, and gradually spread itself over the field. It will also reduce his road tax and give him a better way for travel.

GRUBS AND WIRE WORMS.

Some soils appear to be infested with worms in an unusual degree. What is the cause and what is the remedy for this condition? The first inquiry we should make is, what is the nature of the soil in which these pestiferous insects abound? According to our observations the soil is unusually lean and poor. They do not infest it until it is worn out, or has become exhausted by culture. There may be exceptions, but so frequently have we witnessed the fact that we have been disposed to set it down as established, that a lean soil is at least more subject to the grub, wire worm, &c., than a soil which is in good heart and condition. We are supported in this position by the fact that not only whole fields are greatly infected when worn out and poor, but particular patches of a field become infested, when by any cause they have been subjected to unusual exhaustion. This last year we observed a field planted with corn, one part of which was remarkably fine; but another portion was entirely destroyed by the wire worm. Now this portion was poor and lean, was exhausted by the roots of a large oak. This, to be sure, is not so clear a case, and standing by itself, we should not place much reliance upon it. But in addition to this, we know of farms which being run down, as it is termed, have become so entirely infested that it is difficult to culti-

vate them. Then again, the fact that a soil is usually in this condition when poor, is agreeable to analogy. Animals are not infested with worms until they are lean and poor. Children poorly fed, are the subjects in which worms most abound. On the other hand, children and the young of all animals which are supplied with abundance of nutricious food, are rarely if ever afflicted with parasitic worms. We may look at the subject in another point of view. Animals which are well fed resist the effects of worms. So a soil which is rich, produces plants which are capable of withstanding the injuries of worms. A feeble plant which would be inevitably destroyed by a worm, might, if vigorous, continue to grow and finally outlive the injury. If the views we have expressed are but partially correct, we think we are warranted in the conclusion that one of the best remedies for worms is high cultivation; and as a preservative means, that cultivation which preserves the soil in a good condition is the one which will ensure it against these animals. But admitting that we are not correct in the view we take of the subject, still, we are satisfied that most of the remedies which have been proposed are worthless. Salt, for instance, is not unfrequently recommended, which is to be sowed broadcast over the field. Now, it would seem that if a person would reflect a moment, they would see that the small quantity of this material to which we are restricted, would not have the least effect on the worm; and so of any substance whatever which has hitherto, or which can be recommended for this specific purpose. Soaking the seed in bitter, saline or poisonous substances is by far a more direct method of effecting the object; still it is a question whether even their good effects do not originate from the vigor which the young plant derives from the solution. We leave this subject at this time with one additional recommendation, viz: preserve the birds from the deadly fire of the rascally boys of the neighborhood. We would extend protection even to the crow, that black coated vagabond, as he has been called; every humane farmer, however, will of course see that the birds are not only not destroyed, but protected; and every selfish, narrow contracted one, we should expect, would guard his interest so far, as to prevent the destruction of animals which are of so much importance to him as robins, sparrows, swallows and bluebirds, together with hosts of others equally useful.

EXTRACTS

FROM

DOMESTIC AND FOREIGN JOURNALS.

The importance of obtaining correct analyses of our cultivated vegetables is beginning to be appreciated in the country, and we are happy to see so good an example set by the agricultural societies of Winyaw and All-Saints. We make no apology for extracting from the Southern Agriculturist the entire articles containing the analyses of rice, cotton wool, cotton seed, Indian corn, and the yam or sweet potatoe.

AN ANALYSIS OF RICE, RICE STRAW, CHAFF, &c.

At a meeting of the Agricultural Society of Winyaw and All-Saints, in Georgetown District, in November, 1843, it was proposed that an analysis be made of the grain, straw, chaff, &c., of rice. This was agreed to, and the task committed to Professor C. U. Shepard, of the Medical College of the state of South-Carolina. The following analysis is the result of his chemical investigations, and was handed to Col. Allston, the chairman of the committee appointed to carry the proposition into effect.

Charleston, S. C., April 6th, 1844.

Dear Sir,

I hasten to lay before you at the earliest moment in my power, the report on rice, concerning which I have had communications with yourself and Dr. Parker. I hope it may not disappoint the expectation already formed of the work by yourself, or the society for which it has been executed.

The task has greatly exceeded in difficulty the estimate I formed respecting it at the outset; it having occupied me closely in my laboratory for at least three weeks. The results given in the report are generally deduced from the averages of repeated analyses.

If the society publishes my report, I should feel obliged if a copy would be forwarded to the Hon. Mr. Ellsworth, of the Patent Office, Washington, whom I have led to expect such a favor.

And I have the honor to remain,

Most respectfully, your obedient servant,

CHAS. UPHAM SHEPARD.

Hon. R. F. W. Allston.

CHEMICAL EXAMINATIONS OF THE RICE PLANT AND RICE SOIL IN SOUTH-CAROLINA.

1.—*Of Clean Commercial Rice.*

Burned in a porcelain capsule under the muffle, until all combustible matter had disappeared, a blebby glass-like ash remained, weighing 0.404 per cent, or less than half a part in one hundred of the rice consumed.* Corrected statement of mineral constituents of clean rice=0.487 per cent.

Composition of 100 parts of this residuum.

Phosphate of lime (bone-earth,) with decided traces of intermixed phosphate of magnesia,..	76.20
Phosphate of potassa, nearly 5 per cent,....	
Silica, sometimes as high as 20 per cent.,...	
And the following salts in traces only. They are enumerated in the supposed order of their abundance, viz:	... 24.80
Sulphate of potassa, ...	
Chloride of potassium, ...	
Carbonate of lime,........................	
Carbonate of magnesia, ...	

2.—*Of the Cotyledon, commonly called the eye or chit of the grain.*

Ignited under a muffle on a porcelain plate, it burns with a bright light, and the ash flows into a glass. From the intimate way in which it adhered to the plate, it was impossible to determine its weight, or even its composition, in a satisfactory manner. The expression 6.824 per cent, however, may be taken as an approximation to the weight of the residuum. In composition, it appears scarcely to differ from the ash of clean rice, except in being somewhat richer in lime, and in the phosphoric and sulphuric acids.

3.—*Of the fine Rice Flour, as it comes down on the bulk.*

It gives, on burning, a bulky, porous ash, weighing 10.746 per cent, of the flour consumed. Corrected as above=12.30 per ct.

* It being requisite to determine the inorganic ingredients of rice, and of the various parts of the entire plant, as it may reasonably be supposed they are returned to the soil again on the decomposition of the plant and its parts, (whether taking place spontaneously or otherwise,) and not to give those ingredients in all cases as they are actually yielded to us in the process of destructive analysis, I shall subjoin many of the constituents of the ashy residua not as found, but rather as the principles of chemistry authorise us to deduce them, in accordance with the above requisition.

Composition of 100 *parts of this residuum, as follows:*

Silica, with traces of combined potassa,			38.02
Phosphate of lime, with traces of phosphate of magnesia,			54.60
Phosphate of potassa, (rich in this salt,)			
Sulphate of potassa,			
Sulphate of lime, in traces,		and loss,	7.38
Chloride of calcium, "			
Chloride of potassium "			
Lime and magnesia, "			
			100.00

4.—*Of coarse Rice Flour, from the bulk.*

It gives, on burning, a bulky, porous ash=11.23 per cent. Corrected statement=11.831 per cent.

Composition of 100 *parts of this residuum, as follows:*

Silica, with traces of combined potassa,			69.27
Phosphate of lime, with traces of phosphate of magnesia,			28.94
Phosphate of potassa, (rich in this salt,)			
Carbonate of potass, in traces,			
Sulphate of potassa, "		and loss,	6.79
Lime and magnesia, "			
Chloride of calcium, "			
Chloride of potassium, "			
			100.00

5.—*Of the Husk, commonly called chaff, or offal.*

Burns with little or no flame, into a perfectly white, silicious skeleton of the husk. In weight it equals 13.67 per cent.

Composition of 100 *parts of this residuum, as follows:*

Silica			97.551
Phosphate of lime, with traces of alumina and oxides of iron and manganese,			1.023
Carbonate of lime,			0.294
Phosphate of potassa,			
Sulphate of potassa, in traces,		and loss,	1.132
Chloride of potassium, "			
Carbonate of potassa, "			
			100.000

6.—*Of the Rice Straw.*

Burns into an ash, which is a semi-fused, glassy frit. It weighs 12.422 per cent.

Composition in 100 *parts, as follows:*

Silica,	84.75
Potassa, with probable traces of soda, combined with the the above silica,	8.69
Phosphate of lime, with traces of oxide of iron (and manganese,)	2.00
Carbonate of lime,	2.00
Alumina, in traces, Phosphate of potassa, Carbonate of potassa, Sulphate of potassa, Chloride of potassium, } and loss,	2.56
	100.00

7.—*Rice Soil from Waverly Island.*

Silica, with fine sand, one-third of which is feldspathic and slightly magnesian or talcose; and contains alumina with from 2 to 4 per cent of potassa, mingled with soda and magnesia,	47.75
Alumina, partly combined with humic acid,	12.35
Peroxide of iron (combined with humus,) with decided traces of phosphate of lime, (bone-earth,)	4.15
Carbonate of lime, with traces of magnesia,	0.40
Water of absorption, 8.50; Humus, (organic matter,) 23.50	32.00
Chloride of calcium, Sulphate of lime, Sulphate of magnesia, Sulphate of potassa, Chloride of sodium, } and loss,	1.35
	100.00

8.—*Rice Soil from Woodville, Main, Waverly.*

Silica, with fine sand, as above,	57.50
Alumina, partly combined with humic acid,	10.45
Peroxide of iron (combined with humus,) with decided traces of phosphate of lime,	4.60
Carbonate of lime,	0.40
Carbonate of magnesia,	0.58
Water of absorption, 7.50; Humus, 17.80	25.30
Chloride of calcium, Sulphate of lime, Sulphate of magnesia, Sulphate of potassa, Chloride of sodium, } and loss,	1.17
	100.00

9.—*Rice Soil, from Matanzas on the Main.*

Silica, with fine sand, as above,	60.50
Alumina, partly combined with humic acid,	8.15
Peroxide of iron (combined with humus,) with decided traces of phosphate of lime,	3.00
Carbonate of lime, with traces of magnesia,	0.85
Water of absorption, 9.00; Humus, 18.50	27.50
Chlorides of calcium and of sodium, Sulphates nearly as above, and loss,	1.00
	101.00

10.—*Rice Soil from Dr. Parker.*

Silica, with fine sand, as above,	41.25
Alumina, (combined with humus,)	9.25
Peroxide of iron, (combined with humus,)	3.30
Phosphate of lime,	0.55
Carbonate of lime,	0.85
Carbonate of magnesia,	0.45
Water of absorption, 9.50; Humus, (with odor of ammonia,) 33.50	43.00
Chloride of calcium, abundant, Chloride of sodium, Sulphate of lime, Sulphate of magnesia, Sulphate of potassa, and loss,	1.35
	100.00

Additional particulars, with some consequences from the foregoing.

[1.] 100 parts by weight of rough rice (from which the remains of stems and glume-leaflets had been separated,) gave

82.10 parts of grain, and
17.90 " husk.

100.00

[2.] 100 parts of unhusked grain, gave

95.238 parts of non-cotyledonous grain, and
4.762 " cotyledons, or eyes.

100.00

[3.] 100 parts of non-cotyledonous unhusked grain, gave

94.3 of grain without husk, cotyledon or epidermis,
5.7 of epidermis, or inner coat.

100.00

[4.] 100 parts of rough rice, then has

17.900	husk.
3.909	cotyledon.
4.456	epidermis.
73.735	clean grain.*
100.000	

[5.] The ratio of rough rice to the straw of the harvested grain, deduced from taking the mean of fifteen separate experiments, gave the weight of the grain 53.5, that of the straw, including the panicle or stems, 23.6.

But as many of the leaves appear to have been mutilated, I am disposed to assume as a probable approximation to the truth, the weight of the grain as just double that of the cut straw. And as some observation of the stubble and roots strongly favors the idea of their equaling together the weight of the straw, I shall still farther venture to consider the rough rice of a ripe, harvested plant as equal in weight to that of the entire stem, leaves and root.

[6.] Let us next attempt an approximation towards an appreciation of the mineral constituents of these different portions of the rice plant.

The ash in 100 parts of rough rice equals .7462 parts. And as the ash in 100 of the husk, equals 13.67, that in 17.90 parts of husk must equal 2.446 parts. By difference, therefore, between 2.446 and 4.752, the ash of the cotyledon, epidermis and clean grain, in 100 parts of rough rice, will equal 2.316 parts.

But the percentage of the ash in clean rice being known, we are able to state what the amount of ash is. In clean rice of 100 parts rough rice, it is 0.297 parts. The general statement, then, will stand thus, for 100 parts rough rice.

Ash in the husk,	2.446	parts.
" cotyledon and epidermis,	2.019	"
" clean grain,	0.297	"
	4.762	

[7.] The straw, (including the stubble and root,) having been assumed as equal in weight to the rough grain, the ratio of the mineral ingredients of the former to the latter, stands as 12.422 to 4.762.

[8.] Considering a single rice plant, in its dry, mature state, to weigh 100 grains, (a supposition which will often accord with the fact,) we shall have of mineral matter in the different parts of the plants, the following number of grains :

* From losses sustained to the clean grain, in the process of milling, it is not probable that above 70 parts of commercial rice are afforded by 100 of rough rice.

In the stubble and root, ...	36.08
" straw and pan leaves, ...	36.08
" husk, ...	14.20
" cotyledon and epidermis, ...	11.70
" clean rice,..................	1.94
	100.00

As, however, in the milling, nearly one-sixth of the cotyledon still adheres to the grain, for all practical estimates, it will be nearer the truth to state the mineral ingredients of clean rice at 2 per cent those of the whole crop, and to diminish, therefore, the residuum of the cotyledon and epidermis by 0.06 per cent, making the percentage statement to stand thus:

Stubble and root,..................	36.08
Straw and leaves,.................	36.08
Husk,..........................	14.20
Cotyledon and epidermis,...........	11.64
Clean rice, (commercial,)...........	2.00
	100.00*

[9.] If the foregoing views are correct, it becomes plain, at a glance, that the planter who sells his crop in the condition of rough rice, robs his lands of 27.84 per cent of the mineral ingredients of this species of produce; while, on the other hand, he who sells it as clean rice, subtracts from them but two per cent of these ingredients.

But the true value of these constituents cannot be rightly estimated by their numerical proportions, since the mineral ingredients of the cotyledon and epidermis consist of above fifty per cent of the most precious saline substances, while in those of the stubble, root and husk, the like constituents scarcely rise to ten per cent.

[10.] From the extreme slowness with which the husk suffers conversion into humus, unless fermented with stable litter, this portion of the rice plant appears to be almost wholly neglected by the planter. But as it contains above thirty per cent of carbon, it must be capable, when incorporated with the soil, of performing, to a considerable extent, the functions of humus, *i. e.* of gradually giving rise to carbonic acid from combining with the oxygen of

* It may be useful to present here, also, a *per centum* view of the incombustible constituents of the rough rice.

Husk, ...	51.00
Cotyledon and epidermis,.......	41.81
Clean rice,.....................	7.19

It scarcely need to be stated, that the cotyledon and epidermis are found in the coarse rice flour, intermingled largely with the husk, and with from three to four per cent of powdered clean rice. The cotyledon and the epidermis are richer than the clean rice in saccharine matter and gluten, which materially augment the value of rice flour as a feed for cattle and swine. These principles are thus returned to the soil under the most favorable conditions for agriculture.

the air, and of raising the temperature of the soil by its eremacausis, or slow combustion. Besides, its minutely divided silica is in a more favorable condition for absorption by the rootlets of plants, than that which is offered to them by the soil itself. We may add to these supposed useful properties of the husk, the mechanical service which in certain stiff, compact lands it is capable of exerting, by keeping the ground open to the access of air, and as an absorbent of moisture. As it is unlike to the stalk and leaf, in not containing alkali, it might, perhaps, be found advantageous to add wood ashes along with it to the soils on which it is applied.

The extraordinary results, so fully proven of late, to flow from the use of minutely divided charcoal, would perhaps authorise another mode of treating the rice offal, which is to burn it with a smothered combustion in small kilns, or in heaps partly covered with soil, whereby it might be converted into a species of charcoal. I should anticipate from such a preparation of the husk, whether applied alone, or previously mixed up with putrescent matters into a compost, the most marked effects.*

I conclude this report with the hope that this inquiry, which is by no means supposed to have exhausted the subject, or to have reached that rigid accuracy of result which it is to be hoped may one day be obtained, may afford the rice planter more valid reasons than he before had, for husbanding those mineral elements of his crop with a religious care, the neglect of which, with whatever apparent impunity it may at first be attended, cannot fail in the end to involve him in a hopeless struggle against nature.

C. U. SHEPARD.

Charleston, April 6th, 1844.

AN ANALYSIS OF COTTON WOOL, COTTON SEED, INDIAN CORN, AND THE YAM POTATOE.

1*st. Cotton Wool.*

One hundred parts by weight of cotton-wool on being heated in a platina crucible, so long as a brightly burning gas continued to be emitted, lost 86.09 parts—the residuum being a perfectly charred cotton, which on being ignited under a muffle until every particle of carbon was consumed, lost 12.985, and left an almost purely

* I need scarcely to add, that the different composition of the stem and leaves of the rice, would scarcely justify a similar procedure with these parts of the plant, since unless the temperature be regulated with great care, the silica would form with the the associated alkali, a true glass, which for agricultural purposes, would be nearly as inoperative as common sand.

white ash, whose weight was rather under 1 per cent or, 0.9247. Of this ash, about 44 per cent was found to be soluble in water. It contained 12.88 per cent of silicious sand, which must have been acquired adventitiously in the process of harvesting the fibre. Deducting the sand from the ash, the constitution of the latter is as follows :—

Carbonate of potassa (with possible traces of soda,)		44.19
Phosphate of lime with traces of magnesia, ...		25.44
Carbonate of lime, ...		8.87
Carbonate of magnesia,..........................		6.85
Silica, ...		4.12
Alumina (probably accidental,)		1.40
Sulphate of potassa, ...		2.70
Chloride of potassium,...... Chloride of magnesium,..... Sulphate of lime, ... Phosphate potassa, ... Oxide iron in minute traces, .	and loss, ...	6.43
		100.00

But since it is obvious that the carbonic acid in the above mentioned salts must have been derived during the incineration of the cotton, the following view will more certainly express the important mineral ingredients abstracted by the cotton from the soil for every 100 parts of its ash.

Potassa (with possible traces of soda,)	31.09
Lime, ...	17.05
Magnesia,................................	3.26
Phosphoric acid, ...	12.30
Sulphuric acid,...........................	1.22
	64.92

For every 10,000 lbs. of cotton wool, then, about 60 lbs. of the above mentioned ingredients are subtracted from the soil in the proportion indicated by the numbers appended, *i. e.* omitting fractions.

Potassa,................................	31	pounds.
Lime, ...	17	"
Magnesia,...............................	3	"
Phosphoric acid, ...	12	"
Sulphuric acid, ...	1	"

Several queries were submitted to me along with the sample to be analyzed, relative to the effect of soils on cotton. I regret to state that the almost total ignorance in which we are still left respecting the composition of the varieties of this fibre, and the soils

producing them, prevents me from hazarding any explanations on the subject. This is the first destructive analysis ever made (at least so far as my knowledge extends,) of the cotton wool. Nor am I acquainted with the properties of the soil which afforded it. Prior to any deductions, it is clear we must know the composition of each variety of cotton, as well as that of the soil it affects. At present I can only venture on connecting together two facts, which appear to occupy important relations to one another. The soil of St. Stephen's, which is said by F. A. Porcher, Esq., to be a stiff clayey loam, produces the strongest and finest fibre of the Santee varieties. The Sea-Island qualities are supposed to owe their superiority to the use of marsh mud, which I have ascertained to be a clayey admixture, rich in alkalies and alkaline earths. Whether the similarity between these two staples is influenced most (if it is affected at all,) by the chemical or mechanical qualities of the soils producing them, it is impossible to decide. It is also conceivable that the two sets of qualities may conspire to one and the same end.

2d. Cotton Seed.

One hundred parts, heated as above, lost 77.475, and the thoroughly charred residuum burned under the muffle, left 3.856 parts of a perfectly white ash. The composition was found to be as follows:

Phosphate of lime (with traces of magnesia,)		61.64
Phosphate of potassa (with traces of soda,)		31.51
Sulphate of potassa,		2.55
Silica,		1.74
Carbonate of lime,		0.41
Carbonate of magnesia,		26
Chloride of potassium,		25
Carbonate of potassa,	& loss,	1.64
Sulphate of lime,		
Sulphate of magnesia,		
Alumina & oxides of iron & manganese in traces		
		100.00

In comparing the above table with that afforded by the cotton wool, a marked dissimilarity presents itself. The ash of the cotton seed is fourfold that of the fibre; while the former has also treble the phosphoric acid possessed by the latter, as will the more clearly appear, when we present the analysis under another form, corresponding with the second table under cotton wool.

Phosphoric acid,	45.35
Lime,	29.79
Potassa,	19.40
Sulphuric acid,	1.16
	95.70

From the foregoing analysis it would appear difficult to imagine a vegetable compound, better adapted for fertilizing land, than the cotton seed ; nor can we any longer be surprised at the well known fact, that soils long cropped with this staple, without a return to them of the inorganic matters withdrawn in the seed, become completely exhausted and unproductive.

3d. *Indian Corn.*

One hundred parts heated to redness in a crucible, so long as a brightly burning flame was emitted, lost 81.05 parts. The completely charred residuum on being ignited beneath a muffle, upon a platina foil, until all the carbon was consumed, left 0.95 parts, or less than 1 per cent of an easily flowing clear glass. This ash has the following composition :—

Silica,	38.45
Potassa, (with traces of soda)	19.51
Phosphate of lime,	17.17
Phosphate of magnesia,	13.83
Phosphate of potassa,	2.24
Carb. lime,	2.50
Carb. magnesia,	2.16
Sulphate of lime, Sulphate of magnesia,	.79
Silica, mechanically present,	1.70
Alumina, traces,	
Loss,	1.65
	100.00

Omitting the silica as an unimportant loss to the soil, and the carbonic acid which is a product of the analysis, we have in every 100 parts of the ash of the Indian corn, the following important inorganic constituents :—

Potassa,	20.87
Phosphoric acid,	18.80
Lime,	9.72
Magnesia,	5.76
	55.15

That is to say, for every 1,000 pounds of Indian corn sold from an estate, the land is robbed of 9½ lbs. inorganic matter, whereof

about 5¾ lbs. consist of principles of prime value to all species of crops.*

4th. Sweet Potatoe, (Yam.)

The tubers analysed, though fresh from the market, were obviously drier than when first harvested.

One hundred parts of the thinly sliced tubers on being thoroughly dried at a temperature of 200°, lost 58.97 per cent of water.

One hundred parts of the undried potatoe gave 1.09 parts, or rather over 1 per cent of a white ash stained in points of a bluish green color.

Its composition was as follows :—

Carbonate of potassa, (with traces of soda)		60.00
Phosphate of lime,		14.57
Phosphate of magnesia,		5.60
Carbonate of lime,		5.39
Carbonate of magnesia,		3.80
Chloride of potassium,		4.60
Sulphate of potassa,		4.35
Silica,		.70
Chloride of calcium, Sulphate of magnesia and lime, Alumina, Oxide of iron and manganese in traces,	and loss,	.99
		100.00

One hundred parts of the ash from the sweet potatoe tuber, contains then the following inorganic principles which must have been withdrawn from the soil.

Potassa,	43.59
Phosphoric acid,	11.08
Lime,	10.12
Magnesia,	3.80
Potassium,	2.42
Chlorine,	2.18
Sulphuric acid,	1.90
	85.09

* In a recent number of the Boston Journal of Natural History, I observe some observations by Dr. Charles T. Jackson, on the inorganic constitution of Indian corn, wherein Dr. J. supposes phosphoric acid to be present in the grain, in a free or uncombined state. The experiment which led him to form this conjecture, did by no means succeed in my hands as described by him; for although the grain was repeatedly incinerated upon a bright plantina foil under a muffler, still the metal lost none of its polish or malleability. Neither can I agree with Dr. J. in his opinion of the presence of ammonia as a base in Indian corn; the volatile alkali obtained by him, being a product rather than an educt of the analysis.

Tabular view of some of the foregoing results.

	In Cotton wool.	Cotton seed.	Indian corn.	Potatoe.
Weight of ash,	0.9247 p. c.	3.856 p. c.	0.95 p. c.	1.09 p. c.

Essential inorganic ingredients absorbed from the soil.

	By Cotton wool.	Cotton seed.	Indian corn.	Potatoe.
Potassa, ...	31.09	19.40	20.87	43.59
Lime,.........	17.05	29.79	9.72	10.12
Magnesia,.....	3.26	trace	5.76	3.80
Phosphoric acid,	12.30	45.35	18.80	11.08
Sulphuric acid,.	1.12	1.16	trace	31.90
Chlorine,......	traces	traces	——	2.18
Potassium, ...	——	——	——	2.42

One thousand pounds of each crop give of organic ingredients, of the 1st, 9¼ lbs.; 2d, 38½ lbs.; 3d, 9¼ lbs.; and of the 4th, 10 9-10 lbs.

The proportions of inorganic matter that may be regarded as most important, are—In the 1st, 64-100; in the 2d, 95-100; in the 3d, 55-100; in the 4th, 85-100 lbs.

If equal weights of cotton wool and Indian corn be taken from the same area of land, the deterioration to the soil in organic principles should be nearly the same. The yam, if compared with either of these crops would appear to rob the soil of a still heavier weight of saline matter, although it is noticeable that the proportion of phosphoric acid abstracted by it is considerably less, and that no portion of it is thus withdrawn in the condition of phosphate of potassa.

Finally, under the same weights, the cotton seed removes about four times as much of these ingredients as the yam, and six times the quantity that passes off by the cotton wool, or the Indian corn. Moreover, the proportion of phosphoric acid (the most valued mineral constituent of a soil,) in the cotton seed is nearly double that in Indian corn, and treble that in cotton wool and the yam; whereby the inestimable qualities of the cotton seed as a fertilizer, become still further apparent.

The following letter from Professor Shepard to F. A. Porcher, Esq., has been communicated for publication since the foregoing report.

Charleston, April 22d, 1844.

To Frederick A. Porcher, Esq.

Dear Sir—I thank you for calling my attention to the analysis of Sea-Island cotton wool, by Dr. Ure, as quoted in the valuable Memoir on Cotton by the Hon. W. Seabrook. It is the first notice I ever had of any chemical examination besides my own, of the ash of cotton wool, and it is proper that I should submit a few remarks to your society respecting the different results arrived at in the two cases.

If the example analyzed by Dr. Ure, was a fair one, of which I confess I entertain some doubts, several discrepancies would appear to exist between the two varieties examined. Before alluding to these, however, I beg leave to state, that in my analysis, both of the wool and of the seed, I contented myself with the determination of the proportion of the phosphates, without establishing rigorously the ratio of the magnesia to the lime; neither did my analysis give by itself the chloride of potassium, (muriate of potash.) Yet I am able to add, from a recurrence to my notes, that this compound fell short of three per cent. I am greatly surprised, however, to find the oxide of iron so high in the Sea-Island variety, since in that of the Santee it cannot equal half a part in one hundred. Should the absence of carbonate of magnesia in the Sea-Island variety be verified, and the extraordinary content in the latter of chlorine and sulphuric acid be established, the inorganic difference between the two staples, will, to say the least, be as remarkable as those existing in their physical qualities.

Comparative Statement.

TABLE I.

	Sea-Island.	Santee.
Earthy phosphates,	17.4	25.44
Carbonate of lime,	10.6	8.87
Carbonate of magnesia,		6.85
Chloride of potassium, (muriate of potash,)	9.9	3.00 ?
Sulphate of potassa,	9.3	2.70
Silica,		4.12
Peroxide of iron,	3.0	0.50 ?

TABLE II.

In this table the acids are separated from their bases, and the carbonic acid is omitted.

	Sea-Island.		Santee.
Potassa,	35.24		31.09
Lime,	10.28		17.05
Magnesia,	3.20		3.26
Potassium,	5.70		1.50 ?
Phosphoric acid,	9.84		12.30
Sulphuric acid,	4.75		1.22
Chlorine,	4.20		1.50 ?
Peroxide of iron,	3.00	less than	0.50
Silica,			4.12
Phosphate of potasa,			1.50 ?
	76.11		73.99

Very respectfully, yours,

CHARLES U. SHEPARD.

[From Transactions of Highland Ag. Soc.]

EXPERIMENTS AND OBSERVATIONS ON THE PRODUCTION OF BUTTER.

BY PROFESSOR TRAILL.

The produce of the dairy forms so important a branch of agricultural industry, that it appears surprising how few attempts have been made to investigate the comparative merits of different methods, employed in various places, for the production of butter and cheese. The qualities of these articles are well known to differ greatly in our own country; yet each district has gone on for long periods to follow its own methods, as if each had attained perfection in the art. This is a proof either of the want of any fixed principles to guide us in the practice of these important economical operations, or of their being unknown to the majorty of farmers.

The subject long engaged the attention of the late estimable Dr. Gerard of Liverpool and myself, and for several years, especially in the years 1806 and 1807, we carried on many experiments; in some of which we were assisted by our friend, Dr. Bostock, now of London.

It was originally intended to comprise in our investigations the whole subject of the production of butter and cheese; but our professional avocations, and other interruptions, prevented the completion of our plans, after we had performed numerous experi ments on the production of butter. The hope of being one day able to complete them, has hitherto prevented any account of them being published. On the death of Dr. Gerard, the whole papers, in a state of great confusion, came into my possession; and I now propose to lay before the Highland and Agricultural Society of Scotland the principal results which we obtained.

We had a dairy of four, sometimes of five, cows at our disposal; but, after numerous preliminary trials, we found that the numerical results, on the quantity of the butter obtained, were most uniform and satisfactory when we made each experiment on a few pints of milk only. It is true that the proportional yield of butter was sometimes greater from a large than from a small quantity of cream or milk; but the different experiments were found to be most accordant on being repeated, when we operated on quantities not exceeding six English pints for each churning. This probably arose from our being then able to carry on the process in glass vessels, which permitted us to see the progress of the operation, and to collect the product more perfectly; and also from our

being enabled to use, in experiments on this small scale, a more delicate balance to ascertain the weight of the butter obtained.

We were also thus enabled to make the comparative experiments on the same milk, on the same day—points of essential importance—as the richness of even the same cow's milk is liable to vary considerably from day to day, as we found from experiment, according to her food, her health, and possibly, too, according to the state of the weather. We also found that the time which had elapsed from the last calving had much influence on the quantity of the butter. The quantity of butter was smallest, and the proportion of cheesy matter greatest, just after calving; and generally speaking, the milk of those cows which yielded the *least* quantity of milk, was richest in butyraceous matter. Thus the quantity of butter afforded by a quart of milk of a small Alderney cow was considerably more than from a quart of the milk of the large Lancashire breed.

We proposed to ourselves various objects; such as ascertaining accurately the temperature acquired by milk in churning, (which, I may state in general terms, without detailing the experiments, we found to range from 5° to 8° of Fahrenheit;) the effect of external temperature on the production of butter; the effect of adding water to the churn, as is practised in many places; but, above all, to ascertain the comparative advantages of churning—

1. Sweet cream alone.
2. Sweet milk and cream together.
3. Sour cream, or that slightly acid.
4. Sour milk and cream together.
5. Scalded cream, or what is called *clouted cream*, as practised in Devonshire.

Each of these five methods of preparing the milk afforded very different results; and, as these investigations seem to be the most important, I shall give them more fully than the rest, selecting, from numerous experiments, those which were most carefully performed, and are, therefore, most worthy of confidence. Although the absolute quantity of butter differed with the season and condition of the cattle, yet as the five methods were practised at the same time, on equal quantities of the mingled milk of four or five cows, the comparative results of each series may be considered as not far from the truth.

It is well known that the milk first drawn from the cow is far inferior in quality to that last drawn; the latter is technically, in Lancashire, called the *afterings*, and in many towns generally sold as cream. It seemed also an object of interest to ascertain the comparative quantity of butyraceous matter yielded by the first and last part of the milking, as also the quntity of *caseine* or curd in each.

The principal results of the experiments made, are—

1. That the addition of some cold water during churning, facilitates the process, or the separation of the butter, especially when the cream is thick and the weather hot.

2. That cream alone is more easily churned than a mixture of cream and milk.

3. That butter produced from sweet cream has the finest flavor, when fresh, and appears to keep the longest without acquiring rancidity; but that the buttermilk, so obtained, is poor, and small in quantity.

4. That scalding of the cream, according to the Devonshire method, yields the largest quantity of butter; which if intended for immediate use, is agreeable to the palate and readily saleable; but if intended to be salted, is most liable to acquire, by keeping, a rancid flavor. The process of scalding is troublesome; and the milk, after the removal of the cream is poor, and often would be unsaleable from the taste it has acquired from the heating.

5. That churning the milk and cream together, after they have become slightly acid, seems to be the most economical process on the whole; because it yields a large quantity of excellent butter, and the buttermilk is of a good quality—a point of some importance when buttermilk is largely used as an article of diet, as it is in Lancashire.

6. That the keeping of butter in a sound state appears to depend on its being obtained as free from uncombined albumen, or caseine, and water, as it can be, by means of washing and *working* the butter when taken from the churn.

[From the Journal of Agriculture.]

ON THE WASTE PIECES OF LAND IN CULTIVATED FIELDS.

BY MR. PETER MACKENZIE, STIRLING.

When a piece of ground is enclosed for a garden, it is with the intention that every square foot of it should be put to some useful purpose; for from the centre of the ground to the bottom of the wall vegetation will thrive; and persons accustomed to cultivate every part of the ground of which they have charge, often wonder, as they pass along the highways and byways of their neighborhood, why so much land is allowed to remain undisturbed, in what is considered well cultivated fields. The ground I mean is that which is sometimes called the borders of the field. I have often inquired for a reason why it is not brought into cultivation as well as the rest of the land, and have never received anything

like a satisfactory answer. I have been told by some that they have just been accustomed to such things, and think no more about it; by others that they do not like to go too near the hedges, for fear of destroying the roots of the thorns—but a little reflection soon convinced them that the leading roots of quicksets are generally placed beyond the reach of the plough; and it will be found that the root of a healthy hedge will not be confined to the space that is left unbroken up, but will often be found in the ploughed land. I think it could easily be shown that the farmer is a great loser by allowing so much of his land to remain in an uncultivated state; he must pay for it all, and it must be a great drawback on the productive part of the farm to make up for the deficiency of the unproductive. The space left by the plough untouched is, at least, three feet from the fence, and where open ditches are left in the field it is much more. Supposing a field to be one hundred yards, by five hundred, this will give ten acres, one rood, twelve poles, twenty-seven yards; and with a border three feet wide, left unploughed, will take from it twelve hundred square yards, which is about one rood; and if we take fields of less size than ten acres, the increase of waste land will be greatly augmented. But taking it at one rood to every ten acres, this will give two and a-half acres to every one hundred acres; this is surely too much land to be allowed to be in a state which is worse than useless, for we will be able to show that it has a very baneful effect upon the cultivated crop of the farmer; and if we extend our calculation to the fifteen millions of acres in Britain that are employed in the cultivation of wheat, barley, rye, oats, beans, peas, clover, rye-grass, roots and cabbages, by the plough, it will be found that an enormous quantity of land is in a great measure lost, and I believe the waste is greater in many parts of England than in Scotland. When we bear in mind that many of the fields are small, and separated from one another by enormous double hedges, surely something might be done to lessen the quantity of land that is, from year to year, permitted to be unproductive; five acres for every three hundred acres is worth the looking after, and land, too, in most cases, the best in the country. Supposing the land to be, on an average, worth £2 per acre, and the farm consisting of two hundred acres, what does the farmer get in return for his £10 of rent which he pays for the borders of his fields? The botanist would, perhaps, meet with the richest harvest; he would not be long in collecting one hundred or one hundred and fifty species of plants, all more or less injurious to the farmer. Among the most conspicuous will be the spear thistle, *Cnicus lanceolotus*, common ragwort, *Senecio Jacobœa*, black knapweed, *Centaurea nigra*, and many others that might be named, that prove a lasting scourge to the land, wherever they are permitted to multiply. When they

are allowed to ripen their seeds, the winds of summer and autumn disperse them over the country; and, although they do not make much appearance at first, they are not the less sure of coming at their appointed season. Those of them that are biennial and perennial plants, will make little show for a time; but, when the second year of their existence comes round, they will show themselves in gay colors, and, if allowed to remain undisturbed, will scatter a numerous progeny around them ere they die. The nourishment that docks, thistles and ragworts extract from some fields must be very great; for in some pastures they are very abundant. So convinced was a cottager of the evil effects of permitting weeds to grow and seed among his crops, that he not only kept them out of his own garden, but assisted in destroying those of his neighbors, that they might not seed and come over upon him. By a little extra labor, much land might be reclaimed from the borders of fields, and instead of proving a loss to the cultivator, might become a benefit to the country; for it shows but an imperfect state of cultivation when so many enemies to the crops are permitted to live and die unmolested. In gardens, as well as in fields, the destruction of weeds is often very imperfectly gone about; there are some weeds, such as the *Poa annua*, groundsel and chickweed, that are constantly shedding their seeds, and remaining also in flower at the same time; and, if particular attention be not observed, the old weeds will not be long off the ground, before another race will be pushing their way to supply the room of those that had been removed; and, if they are only left for a short time, they will play the part which their forefathers did before them—shed their seed—and, if left undisturbed, would soon become possessors of the land.

One important step towards the eradication of agricultural weeds, would be to have as few open ditches as possible in the fields under cultivation. Some time ago, I was told, by one of the leading agriculturists of Britain, that there should be none; for they are not required where land is properly drained. Ditches are commonly formed where thorn hedges are planted, in order to supply earth for the benefit of the roots of the plants; but it is allowed by many farmers that, if the land be well prepared, quickset hedges will thrive better in soil that is not thrown up in the usual way of planting, the roots not being so far from the influence of the sun or air as those that are planted in the common way, and that they will seek nourishment from both the fields which they divide, instead of being confined to one. Open ditches are often found to be very inconvenient when a hedge requires its annual cutting; a ditch four feet wide is too much stride across and work freely, and in many cases, the searsement next the hedge, by frequent cleaning, and the action of the weather, is worn away,

so that the person who works with the switching-bill has to stand in the ditch; and when the ditch is two and a-half feet deep, and the hedge four feet high, the work is both unpleasant and slowly performed; for the highest part of the fence is the place where the shoots are strongest, and, of course, most difficult to cut. It will be seen that more than one advantage will be gained by banishing open ditches from fields where it can conveniently be done, and, in many cases, it can be done with little expense and trouble. They can be made into drains, and filled with such materials as are commonly used in draining land, and the filling with soil is done very simply—by means of the plough taking earth from the headlands or sides of the field, so that, in a short time, the farmer may have the cultivated part of his farm considerably enlarged at very little expense; for I have been informed, by those who have tried the experiment, that they were more than paid for their trouble by the first year's crop. More land could be broken up by the plough than is commonly done. It is the practice of some farmers, after ploughing as much as can be properly done by two horses, afterwards to use one, and by altering the line of draught, are enabled to come a little nearer to the fence. Still there is some land left—could it not be brought into cultivation in the same manner that the acute angles of fields are managed, namely, by digging? A laborer or two would not be very long in digging what may be left by the plough; they could do it on day's wages or piece-work, as may be found answerable. It is done by nurserymen and market-gardeners, who have generally higher rents to pay for their land than farmers, and if they find a remuneration for their outlay, would it not be profitable also for the agriculturist? It would increase the produce of the farm in that which would be useful, and also cut off the source from which many of the foes of the cultivated crops are propagated; and the nearer the farm can be brought to that of a well cultivated garden, the better will it be for the producers of food as well as for the consumers; and surely it would add to the prosperity of the country, when, instead of the thistle shall come up the wheat, and instead of the cockle, shall come up the barley. If such simple means were adopted for increasing the produce of the farm, it would enable many tenants to look forward with a lighter heart towards the rent-day, and also to banish from their grounds many of the enemies that assail the labors of their hands.

[From the Britannia.]

CULTURE OF THE GRAPE VINE.

A Descriptive Account of an improved Method of Planting and Managing the Roots of Grape Vines. By Clement Hoare. *Longman.*

The results of Mr. Hoare in the management of vines are so wonderful, considering the simple means he takes to produce them, that we should be inclined to view his assertions as too marvellous for belief, if we did not know that he is himself one of the most successful cultivators of the vine who ever lived in England, and if he did not assure us that he "has not recommended any point of culture the merits and advantages of which he has not himself for years repeatedly and carefully tested." We glance at a few of the principal topics in this ingenious treatise, which we earnestly commend to the notice not only of the horticultural world, but of every one who loves a garden, and desires to see it yield at a very small cost an ample supply of delicious grapes.

For the management of vines in greenhouses, Mr. Hoare strongly reprobates the practice of planting the roots in richly manured borders. His theory is, that grapes are formed and brought to perfection, not from any nourishment received from their roots, but by solar heat and light alone, and that the roots of vines in this country are so far from requiring any stimulative power, that they require to be checked, that the growth of the branches may not be too rapid. This check, he explains, is afforded in warmer countries than our own by the great dryness of the climate and the superior heat of the sun, so that the tops of the shoots as they advance in growth are turned into a kind of jelly, and rapidly harden into wood, which thus becomes firm and close in texture, and bears buds at very short intervals. But from that check not existing to the same extent in England, our climate being more humid, and our sun less fervent, the vine has a natural tendency to luxuriance in growth, the branches are long and tender, and the buds on them at much longer intervals. This theory is explained with delightful clearness in Mr. Hoare's treatise, and illustrated by a decisive example:

Some few years since the author received a bundle of vine cuttings from one of the most celebrated vineyards in Spain. They were the entire growth of the year, as each had a portion of the preceding year's wood attached to it. The longest shoot measured eight and a half feet, but the average length was about eight feet. The wood was perfectly cylindrical, and of the closest texture, and almost as hard as heart of oak. The buds were large, promi-

nent, and highly symmetrical, and stood out in bold relief on the sides of the canes. They were produced so near to each other as to be only one and three quarters of an inch apart. Now, a corresponding shoot produced in this country by an established vine would be about twenty-five feet in length, and the buds would be, on an average, distant from each other betwixt four and five inches. The shoots produced in these different countries, therefore, would each contain pretty nearly the same number of buds; and the question immediately arises, what was the cause of the great disproportion that existed in the length of these shoots? Simply, no other than the greater intensity of the light and heat which the Spanish shoots enjoyed over the English shoot. Nature was as long manufacturing one and three quarters of an inch of wood in Spain as she was four and a half inches in this country; but then, in the former instance, the bright light of the sun, and the intensity of his rays, would not let the shoot go ahead. Their united influence caused it to linger in its growth, and its watery sap, therefore, was turned into a jelly-like substance almost as fast as it was produced, and then fine fruit buds were the natural consequence. And these shoots may be considered as types of all others produced within the vinous latitude.

It follows, then, that in England the roots of vines do not want stimulating, but that the soil for them should be like that which they enjoy in the finest countries, dry, rocky and warm. He considers it extremely detrimental to a vine that its roots should be in a soil where perhaps the temperature is 34 or 40 degrees, while the branches should be luxuriating in a temperature of 70 or 80 degrees. He would, therefore, for all vines in greenhouses prepare an artificial bed for their roots, as he prepares an artificial climate for their branches and fruit. The principle on which he would form this bed, for we do not here pretend to enter into details, is that of making a pit in the earth, three feet deep, and four or five feet square, lining it with solid brickwork, so that the roots of the vine shall not pierce through, and filling it with broken bricks, mortar, charcoal, and bones. These materials should be used in equal proportions, without admixture of any other substances. The bricks should not be too hard-burned, and the mortar should be old. Those, with the charcoal, should be in lumps, about the size of an egg. The bones, if hollow, should be broken in half, that the roots may creep into the cavities. Any will do, but they should be of animals that have arrived at maturity, from their greater hardness. These substances should be well packed, and the vine-root carefully placed in them. The flooring should be of firm brickwork, with one row of bricks loosely laid, that they may be taken up to afford the roots moisture when required.

The result of this treatment is that the roots, being furnished with the largest possible extent of surface, and with the best nutri-

ment in the shape of bones, will give vigor to the vine, and that grapes will be produced six weeks earlier than on other vines, while the bed will last good, if not forever, for an immense number of years.

All this part of the treatise may be read with much advantage by those who possess greenhouses. We come now to that more novel part of the volume, intended for those who would like, with little cost or trouble, to grow grapes in the open air.

In commencing this part of his subject, Mr. Hoare lays it down as a rule that the roots of a vine will strike equally well upwards as downwards. The great requisites for the soil are warmth, moderate dryness, and great extent of surface. He proposes to secure those requisites by building of good brickwork a hollow column, three feet in diameter and five feet high. He prefers circular erections because the vine may be easier trained, and during the height of summer the sun will shine all around it. The base of this column should be formed of solid brickwork level with the earth, and four feet square. When that is finished the erection of the column should be commenced on it; half bricks will do, if they are perfectly strengthened at four equally distant parts of the circle by one course of whole bricks. When two courses of bricks have been thus laid down over the foundation of brickwork, the interior of the column should be filled with the substances before described, broken bricks, old mortar, charcoal, and bones, all being closely packed. A half circular hole should now be cut in a brick on that side of the column facing the south, for the stem of the vine to be brought through. It should be one and a half inch in diameter, and the like hole should be cut in the brick meant to fit on it, so that the cavity may be round, and the dimension of it one and a half inch. The vine should now be planted. It should be three years old, and the bole of earth round the roots be loosely bound round in flannel well soaked in soap-suds. So much of the stem should be left outside the column as contains three good buds. The soil should be a little raked away for the roots to lie in, and the substances should then be packed closely round the roots, care being taken that they are so placed that no mice shall creep in through the hole made for the stem of the vine to pass through. The next course of the bricks should then be laid on, the soil being filled in as the column rises, and so on until the column rises within three courses of its intended height. Then a course of bricks is laid over the well packed substances at top, being jointed with mortar only, and not laying a bed of it. With two more top courses the column will be finished, care being taken so to lay them as that they shall slope towards the centre of the column, forming a cavity to catch moisture, which, piercing through the brickwork, will descend to the soil. In this cavity mignionette or any shrub

of the kind may be placed, which will give it a pretty finish, and hang over from its top. The hole for the stem of the vine may be filled in with moss to give it a pretty appearance. As the vine grows it is to be trained round the column, and with moderate care, Mr. Hoare asserts, may be made to bear fifty pounds of fine grapes in one season. The cost of the column, he believes, should not exceed 25s., but we hardly imagine it could be properly erected for that sum.

It is easy to believe that such columns, when erected in suitable situations, and the vines are well trained around them, and clusters of grapes appear, must add to the beauty of grounds. They may be planted singly or in groups; and the cost is so slight, and the gain in fruit, according to our author, so certain and so large, that the experiment is well worth trying. We have but given an outline of Mr. Hoare's plan. Those who are desirous of further information must consult this pleasing treatise. They will find it full of instructive details, the result of extensive management, directed by an intelligent mind, and of long experience. The manner of the remarks is clear and pleasing, and the whole treatise of eminent utility to those who have the care of vines, or who propose to engage in their culture.

[Abridged from the Scottish Journal of Agriculture.]

ON THE EFFECTS OF SOAKING SEEDS IN CHEMICAL SOLUTIONS.

There was perhaps no object in the exhibition of plants in the society's show, at Dundee, in August, 1843, which attracted such general attention as the remarkably strong and vigorous oats growing in soil, exhibited by Mr. James Campbell, of the Educational Seminaries of that town. The soil in which they grew possessed no peculiar property, except that it had not been manured for eleven years. The vigor of the plants, according to Mr. Campbell, was entirely to be ascribed to their seed having been subjected to a process by which they were soaked in certain chemical solutions. Mr. Campbell has, since the show, in the most liberal and disinterested manner, placed the particulars of his process in the hands of the society, for the benefit of agriculturists generally; and to further his good intentions, the society has thought it proper to publish his own explanation of the method of conducting the process of preparing the seed, as it is given in a letter to the secretary.

"I steeped the seeds of the various specimens exhibited in sulphate, nitrate, and muriate of ammonia, in nitrate of soda and potass, and in combinations of these; and in all cases the results were highly favorable. For example—seeds of wheat steeped in sulphate of ammonia on the 5th of July, had by the 10th of August, the last day of the show, tillered into nine, ten, and eleven stems of nearly equal vigor: while seeds of the same sample, unprepared, and sown at the same time in the same soil, had not tillered into more than two, three, and four stems.

I prepared the various mixtures from the above specified salts exactly neutralized, and then added from eight to twelve measures of water. The time of steeping varied from fifty to ninety-four hours, at a temperature of about 60 degrees Fahrenheit. I found, however, that barley does not succeed so well if steeped beyond sixty hours.

Rye-grass and other gramineous seeds do with steeping from sixteen to twenty hours, and clover from eight to ten, but not more; for, being bi-lobate, they are apt to swell too much and burst.

The very superior specimens of tall oats, averaging one hundred and sixty grains on each stem, and eight available stems from each seed, were prepared from sulphate of ammonia. The specimens of barley and bere were prepared from nitrate of ammonia; the former had an average of *ten* available stems, and each stem an average of thirty-four grains in the ear; and the latter an average of also ten available stems, with seventy-two grains in the ear.

The other specimens of oats which were next the most prolific, were from muriate of ammonia; and the promiscuous specimens of oats were from nitrates of soda and potass—strong, numerous in stems (some having not less than fifty-two), and not so tall as either the preparation from the sulphate or muriate of ammonia.

It was objected by some that the tallest oats were too rank, and would break down before coming to seed; but I have no fear of that, as they were strong in proportion to their height; and should there even be any ground for the objection, I am confident that a combination of sulphates of ammonia and soda, or potass, would rectify the excess of height, and render the grain equally productive.

I have at present a series of experiments going on in the country, with seeds prepared in *seven* different ways, and sown in pure sand, and in a tilly subsoil, taken six feet from under the surface, and in which there is no humus or organic matter of any kind. Along with the prepared seeds are also some *unprepared*, and I expect to be able to form a comparative estimate of their growth by visiting the place in October.

At all events, from the experiments which I have already tried, I am quite satisfied that, even *without* the application of common

manures, double crops, at least, may thus be raised; and under the application of the ordinary manures, crops *tenfold* greater than usual.

The various salts were prepared by me from their carbonates. I am, &c."

[From the Spectator.]

MODEL FARMS IN IRELAND AND SCOTLAND.

An important step has been made to promote agricultural education in Scotland. During the late agricultural meeting in Glasgow, a number of gentlemen favorable to the establishment of elementary schools for the purpose, met in the merchants' hall; when, besides gentlemen connected with the Agricultural Chemistry Association of Scotland, several strangers attended, including Lord Wallscourt, Lord Clements, Lord Ranelagh, Sir Robert Bateson, Sir R. Houston, and others. The Lord Justice Clerk took the chair; and Professor Johnston explained the object of the meeting. Mr. Skilling, superintendent of a model farm at Glassnevin, near Dublin, under the Irish Board of Education, made a statement of the measures carried out by the board since 1838. There are now three thousand teachers under the board; there are seven training establishments to supply teachers, but there will shortly be twenty-five; and it is intended to plant one in every county of Ireland. Mr. Skilling described the plan pursued at the Glassnevin training school, established in 1838; the class of labor is limited to spade husbandry, only the spade and wheel-barrow being used:

"The scholars, amounting to sixty or seventy, were lodged near the farm, and fed from it. After being engaged on the farm in the mornings of five days in the week, they went into the town for their literary education; but the *whole* of Saturday was appropriated to examinations. They had a garden, and, in connexion with it, a competent gardener, who lectured for one half hour in the morning; and he (Mr. Skilling) also lectured to the young men on agricultural subjects. At stated periods, the teachers attended the farm, and witnessed every practical operation which was going on upon it. They observed every system of cropping, and got explanations on every subject with which they were unacquainted; and the result was, that when they went away at the end of the course, they were found to be vastly improved in the scientific knowledge of agriculture and its practical details. During the course, they were enabled to obtain a considerable knowledge of

agriculture, chemistry, and geology; they also received practical information as to the principles of rotation in cropping, the cultivation of green crops, and the like. The practical errors which existed as to the management of land were also pointed out to them—such as the loss caused by bad fences, seedling-beds for weeds, &c.; and on the other hand, they were shown the advantages of draining, and opening and turning the land, and the beneficial results of these on the general management."

This model farm had not only paid its rent, but returned a profit of £150 or £170 a year. Afterwards, five boys educated in a training school at Larne, in the north of Ireland, were introduced and examined:

"They seemed to belong to the better class of peasantry, being clad in homely garbs; and they appeared to be from twelve to fourteen or fifteen years of age. They were examined, in the first instance, by Mr. Gibson (inspector of schools) on grammar, geography, and arithmetic; and scarcely a single question did they fail to answer correctly. They were then examined by Professor Johnston on the scientific branches; and by Mr. Finnie of Swanston and Mr. Alexander of Southbar, on the practical departments of agriculture. Their acquaintance with these was alike delightful and astonishing. They detailed the chemical constitution of the soil, and the effect of manures, the land best fitted for green crops, the different kinds of grain crops, the dairy, and the system of rotation. Many of these answers required considerable exercise of reflection; and as previous concert between themselves and the gentlemen by whom they were examined was out of the question, their acquirements seemed to take the meeting quite by surprise; at the same time that they afforded it the utmost satisfaction, as evincing how much could be done by a proper system of training. The youths and their teachers retired amidst much applause."

Lord Clements bore testimony to the eagerness for instruction evinced by the peasantry near his property, in the wildest part of Connaught; men twenty years of age coming from a distance of many miles to attend the school. Mr. Atlee, the teacher of an agricultural school, on Lady Noel Byron's property, at Ealing, reported the success of that establishment; there were at that moment five hundred applicants for admission to the farm as boarders.

Principal Macfarlan advocated education in agriculture; but exhorted the meeting to carry on their improvements in accordance with the feelings of the people, not shocking their habits by rash innovations. He moved a resolution, that elementary instruction should be afforded to the rural population of Scotland. This was seconded by Mr. Alexander of Southbar, and carried unanimously.

Colonel Lindsay, of Balcarras, declared that the people of Scotland must make haste lest they should be behind in the progress of improvement—

"He must congratulate these young men from Ireland on the admirable display they had made. To be a Scotsman was often found a recommendation in procuring employment elsewhere; but these young men from Ireland would soon show to Scotsmen that they were behind the Irish, and that, if they would maintain their high character for industry and intelligence, they must be instructed as they were. These lads from Ireland had evinced so much agricultural information, that, when ready for employment, they had only to ask to obtain it. He was almost ashamed to admit his belief, that there was not a similar class of youths in Scotland who would answer the questions as these Irish lads had done."

[From the American Agriculturist.]

INCUBATION.

In an impregnated egg previous to the commencement of incubation, a small spot is discernible upon the yolk, composed apparently of a membraneous sac or bag, containing a fluid matter, in which swims the embryo of the future chick, and seemingly connected with other vesicles around it.

1st Day. In a few hours after exposure to the proper temperature, the microscope discovers that a humid matter has formed within the limits of the embryo. At the expiration of twelve or fourteen hours, this matter bears some resemblance to the shape of a little head; a number of new vesicles also successively appear, foreshadowing the different parts of the future body of the chick; those first formed, and most easily distinguished, may afterward be recognized as assuming the shape of the vertebral bones of the back.

2d Day. The eyes begin to make their appearance about the 30th hour, and additional vessels, closely joined together, indicate the situation of the navel. The brain and spinal marrow, rudiments of the wings, and principal muscles, become observable. The formation of the head is also evidently proceeding.

3d Day. The beating of the heart is perceptible, although no blood is visible; after a few hours, however, two vesicles, containing blood, make their appearance. One forming the left ventricle, the other the great artery. The auricle of the heart is next seen, and, in the whole, pulsation is evident.

4th Day. The wings now assume a more defined shape, and the increased size of the head renders the globules containing the brain, the beak and the front and hind part of the head, distinctly visible.

5th Day. The liver makes its appearance, and both auricles, now plainly seen, approach nearer the heart than before. That splendid phenomenon, the circulation of the blood, is now evident.

6th Day. The lungs and stomach are distinguishable, and the full gush of blood from the heart is distinctly apparent.

7th Day. The intestines, veins and upper mandible become visible, and the brain begins to assume a distinct form.

8th Day. The beak for the first time opens, and the formation of flesh upon the breast commences.

9th Day. The deposition of matter forming the ribs takes place, and the gall bladder is perceptible.

10th Day. The bile is distinguishable by its green color, and the first voluntary motion of the body of the chick is seen, if separated from its integuments.

11th Day. The matter forming the skull now becomes cartilaginous, and the protrusion of feathers may be noticed.

12th Day. The orbits of sight are apparent, and the ribs are perfected.

13th Day. The spleen gradually approaches to its proper position in the stomach.

14th Day. The lungs become enclosed within the breast.

15th, 16th, and 17th Days. During these days, the infinity of phenomena in this wonderful piece of vital mechanism elaborate it into more perfect form, and it presents an appearance closely approaching the mature state. The yolk of the egg, however, from which it derives its nourishment, is still outside the body.

18th Day. On the eighteenth day, the outward and audible sign of developed life is apparent, by the faint piping of the chick being, for the first time, heard.

19th, 20th, and 21st Days. Continually increasing in size and strength, the remainder of the yolk gradually becomes enclosed within its body; then, with uncommon power, for so small and frail a being, it liberates itself from its prison in a peculiar and curious manner, by repeated efforts made with its bill, seconded by muscular exertion with its limbs, and emerges into a new existence.

The position of the chicken in the shell, is such as to occupy the least possible space. The head, which is large and heavy in proportion to the rest of the body, is placed in front of the abdomen, with its beak under the right wing; the feet are gathered up like a bird trussed for the spit, yet in this singular manner, and apparently uncomfortable position, it is by no means cramped or confined, but performs all the necessary motions and efforts required for its liberation, with the most perfect ease, and that consummate skill which instinct renders almost infallible.

The chicken, at the time it breaks the shell, is *heavier* than the whole egg was at first.

An egg will not hatch *in vacuo*.

The infinite wisdom of the Great Architect of the animal frame is remarkably manifested in its providing the chick with a sharp and hard substance on the tip of the bill, by means of which it is enabled to fracture the shell to liberate itself from its imprisonment. Its own bill is too soft to enable it to break the shell therewith, and in two days or less this hard and pointed substance disappears, the young bird no longer requiring to use it.

Equally extraordinary and wonderful is the fact that the germ of the chick is provided with the ability to keep itself always on the top of the yolk of the egg, to the end that it may take the heat from the parent bird when setting, to produce incubation.

[From the Transactions of the Highland Society.]

REARING CATTLE, WITH A VIEW TO EARLY MATURITY.

The production of beef at the quickest and cheapest rate being the object in view, the first requisite is a stock of cows possessing qualities suitable for this purpose. Accordingly, they should be good milkers, able to keep at the rate of two and a half to three calves each, of a kind known to have a tendency to fatten readily, and to come early to maturity, and of a structure likely to produce a vigorous, well-grown steer. In other words, they must be good short-horns; only having more regard to their milking properties than is usually done by breeders of bulls. And here it may be well to notice, that it is in general highly inexpedient for the beef grower—the farmer who depends largely on his regular cast of fat cattle—to attempt breeding his own bull. It is only a few individuals in any district who have the taste and skill requisite for this difficult department of the business, not to mention the large capital which must necessarily be invested in it, the precariousness of the return, the greater liability to casualties of such high-bred animals, and the additional expense of their housing and maintenance. On Tweed-side, the breeding of bulls is confined to a very limited number of persons, chiefly Northumbrians, who, by devoting their whole attention to this department, are able, from year to year, to furnish a class of bulls which are steadily improving the general breed of the district. The contrary practice is at this moment compromising the character of this valuable breed of cattle in several districts of Scotland into which they have been more recently introduced. Made wiser on this point by experience, the

farmer of the Border purchases from some breeder of established reputation a good yearling bull, which he uses for two or three seasons, and then replaces by another in like manner. This bull serves his own cows and those of his hinds, and some of the neighboring villagers; and thus, though his own stud be limited to six or eight cows, he can select from the progeny of his own bull as many calves as he requires to make up his lot, and has them more uniform in color and quality than could otherwise be the case. As the male parent among sheep and cattle is known to exert by far the greater influence in giving character to the progeny, and increasingly so in proportion to the purity of his breeding, it is evidently much to the advantage of the beef grower to spare no reasonable trouble and expense in obtaining a bull of thorough purity, and then to select his calves with the most scrupulous attention. From overlooking all this, how often may lots of cattle be seen, on the best of land too, which can only be fattened at an enormous expense of food and time, and, after all, are so coarse in quality as to realize an inferior price per stone! Occasionally a few beasts of the right sort will be seen in such lots, which, by going ahead of their fellows to the extent of £4 or £5 a piece of actual market value, shew what might have been done by greater skill or attention on the part of the owner. It is very desirable to have all the cows to calve betwixt the 1st of February and the 1st of April. If earlier, they will get almost dry ere the grass comes, and calves later than this will scarcely be fit for sale with the rest of the lot. When a calf is dropped, it is immediately removed from its dam, rubbed dry, with a coarse cloth or whisp of straw (this being what the cow would do for it with her tongue, if allowed), and then placed in a crib in the calf-house among dry straw, when it receives a portion of its own mother's first milk, which, being of a purgative quality, is just what is needed by the young animal. For a fortnight, new milk is the only food suitable for it, and of this it should receive a liberal allowance thrice a day; but means should now be used to train it to eat linseed cake and sliced Swedish turnip; and the readiest way of doing so is to put a bit of cake into its mouth immediately after getting its milk, as it will then suck greedily at anything it can get hold of. By repeating this a few times, and placing a few pieces in its trough, it will usually take to this food freely; and whenever this is the case, it should have as much as it can eat, that its allowance of milk may be diminished, to meet the necessities of the younger calves which are coming in succession. This is of the greater importance that it is always most desirable to avoid mixing anything with their milk by way of helping the quantity. When a substitute must be resorted to, oatmeal porridge mixed with the new milk is perhaps the best.

Sago has of late years been much used for this purpose; but an eminent English veterinary surgeon has recently expressed a very decided opinion that its use impairs the digestive powers of the animal, and predisposes to disease. The sour smell invariably found in a calf-house, where porridge or jelly of any kind is mixed with the milk, is proof sufficient that indigestion is the consequence. An egg put into each calf's allowance, and mixed with the milk by stirring with the hand, is a good help, and never does harm: but, with this exception, it is best to give the milk warm and unadulterated, however small the quantity; and along with this, dry farinaceous food, turnips and hay, *ad libitum*. If more liquid is needed, a pail with water may be put within their reach, as this does not produce the bad effect of mixed milk. Indeed, in this it is best to keep as closely as possible to the natural arrangement according to which the calf takes its suck—at first frequently, and then at longer intervals, as it becomes able to eat of the same food as its dam. The diet of the cows at this season is a matter of some consequence. Swedish turnips yield the richest milk, but it is too scanty, and calves fed on it are liable to inflammatory attacks; globe turnips should therefore form their principal food during the spring months. Care must also be taken that they do not get too low in condition in the autumn and winter, and for this end it is well to put them dry at least three months before calving. Some may think this long; but, on a breeding farm, milk is of little value at this season. The cows, when dry, are kept at less expense, and, by this period of rest, their constitution is invigorated, greater justice done to the fœtus, now rapidly advancing to maturity, and so much more milk obtained after calving, when it is really valuable. When the calves are from four to six weeks old, they are removed from their separate cribs to a house where several can be accommodated together, and have room to frisk about. So soon as the feeding yards are cleared of the fat cattle, the calves are put into the most sheltered one, where they have still more room, and are gradually prepared for being turned to grass; and, when this is done, they are still brought in at night for some time. At six weeks old, the mid-day allowance of milk is discontinued, and at about fourteen weeks they are weaned altogether. When this is done, their allowance of linseed cake is increased: and as they have been trained to its use, they readily eat enough to improve in condition at this crisis, instead of having their growth checked, and acquiring the large belly and unthrifty appearance which used to be considered an unavoidable consequence of weaning. The cake is continued until they have so evidently taken with the grass as to be able to dispense with it. They are not allowed to lie out very late in autumn, but, as the nights begin to lengthen and get chilly, are brought in during the night, and receive a foddering of tares and clover fog-

gage. When put on turnips, the daily allowance of cake (say 1 lb. each) is resumed, and continued steadily through the winter and spring, until they are again turned to grass. This not merely promotes their growth and feeding, but (so far as five or six years' experience can determine the point) seems a specific against black-leg, which was often so fatal as altogether to deter many farmers from breeding. It may be well to state here distinctly the particular purpose for which cake is given at the different stages of their growth. At first, the object is to accustom them to a wholesome and nutricious diet, which will supplement the milk obtained from any given number of cows, so as to admit of a greater number of calves being reared, and at the same time have greater justice done them than could otherwise be practicable. At weaning time, again, it is given to help the young animal over the transition from milk to grass alone, without check to growth or loss of condition. During the following winter, however, the special object of its use is to prevent black-leg, as, but for this, turnips *ad libitum* would be sufficient. When put to grass as year-olds, they decidedly thrive better on sown grass of the first year than on old pasture, differing in this respect from cattle whose growth is matured. They are laid on turnips again as early in the autumn as these are ready ; and it is a good practice to sow a few acres of globes to be ready for this express purpose. It does well to give the turnips upon the grass for ten or fourteen days before putting them finally into the feeding yards; and then, if they can be kept dry and warm, and receive daily as many good turnips as they can possibly eat (globe till Christmas and Swedish afterwards), they will grow at a rate that will afford their owner daily pleasure in watching their progress, and reach a weight by the 1st of May which, if markets are favorable, will reward him well for his pains. The leading features of this system are uniform good keeping and progressive improvement; in other words, to get them fat as soon after their birth as possible, and keep them so till they reach maturity. The details given above are a description of the expedients generally adopted by the breeders of this district for securing these objects.

[From the last Report of the Commissioner of Patents.]

SILK.

During the past year the silk business in this country has been steadily advancing. A greater interest is evidently felt in the subject; the evidence is decisive, that it needs only patient perseverance to accomplish greater things than its warmest advocates have

ventured to hope for. A well represented national convention on the subject was held at New-York in October last, at the time of the fair of the American Institute, by the direction of which a great number of letters and communications from persons engaged in the business in all parts of the United States have been published in a pamphlet called "*The Silk Question settled.*" The statements contained in this publication furnish the most complete view of the condition of the business of cultivation of the mulberry, raising and feeding worms, and the manufacture of silk, with the methods best adapted to success, that has before been presented to the public. Twelve states were represented by the appearance of a delegation in person, and communications were received also from the residents of eight more. From the various other information, as well as from this publication, it is evident that there has been an increase of attention to this crop all over the United States. In New-England it does not probably equal that of some other sections of the country. Some scattered notices may help in estimating the crop of the first year; but much reliance will be placed on the publication just mentioned, and we shall endeavor to condense some of the important results and conclusions on account of their eminently practical bearing and utility. The greatest increase in the crop seems to have taken place at the west. The states of Ohio, Tennessee, and Indiana, have several enterprising men whose influence has been felt in urging forward this business, and the advance is most encouraging. It is very difficult to fix on any ratio, and the estimate of the table will probably, in many cases, fall far below the actual progress; but there is sufficient to show that there is a steady increase from year to year. In the New-England states, Connecticut and Massachusetts stand foremost in their attention to silk. In Connecticut, the effect of the exertions of some ardent friends of the cause, previous to the revolutionary war and just about the close of the last century, is still felt; and several establishments, especially in the town of Mansfield and vicinity, show what might have been done through the whole country had the same perseverance been manifested, in spite of early discouragements, and the same willingness to be contented with moderate profits. The experience of that little town warrants the belief that is expressed by some of its inhabitants, that "the time is not far distant when we, as a country, shall raise our own silk and manufacture it, and ultimately compete with foreign nations." From Massachusetts we learn that "the country has taken hold of it in earnest; each year, for some years, has doubled on the preceding. Last year (1842) 400 or 500 were engaged in that business in Massachusetts, and more than double that number in New-England." Several establishments for its manufacture are found in this state in successful operation. In parts of Vermont there are also individuals who are devoting con-

siderable attention to the production of silk ; but, as the climate is so much colder here, and in Maine and New-Hampshire, than in any other New-England states, they are less favorably situated for the business. It is, however, increasing, and among other things on this subject, it is stated that several thousand dollars worth of the eggs of the silkworm have been sent to the West Indies. There is a bounty given by the state government ; and one person expresses his opinion that "five acres of trees, of the age of four years from the seed, will produce more net profit than can be realized from 200 sheep, or a dairy of 20 cows ; and he adds, "I trust the day is not far distant when the raising of silk will be considered as profitable a business as that of raising wool."

In New-York, the number of persons who are waking up to the importance of this subject is increasing. At the fair of the New-York State Agricultural Society, the crop of nineteen persons in a single district of the country was 2,150 lbs. In Monroe county, the quantity offered for the state bounty was said to be 2,256 lbs.; the year before, it was 1,695 ; in 1841, 1,539 lbs.

There are two or three fine establishments for the manufacture of silk in New-Jersey, and for some time there was formerly published a paper relative to this subject in this state.

Pennsylvania formerly gave a bounty on the production of cocoons or silk, but the law, it is said, has been repealed. This has exerted some unfavorable influence, and probably prevented the progress of the crop as much in this large state, as would have been the case had the encouragement been continued. The following statement shows what has been the progress of the silk culture at Economy, in five years, commencing in 1838 :

Years.	No. of lbs. of cocoons.
1838,	1,400
1839,	1,800
1840,	2,400
1841,	4,400
1842,	5,500
In five years,	15,500

The largest crop raised at one establishment in Europe, 200 years after the culture of silk was introduced, it is said, was 3,000 lbs.

In Maryland are some ardent friends of this object ; and though some have been unsuccessful in past years, in respect to the multicaulis, yet the belief is expressed that the silk business is yet destined to do well.

For the southern states this business of silk culture is admirably adapted, and yet comparatively little has been done with regard to it there. The climate is so much milder, and the means of taking

care of the worms are so abundant, that there is every facility for raising large crops. On this subject we have the opinion of some residents in that part of the country. One of them writes thus: "The great difficulty in all matters of improvements in the south, is, it is too small a business—too much trouble, or too long to get the return. My own opinion is, that it is to us of the south the greatest business that has ever presented itself. An old negro, competent to feed young children or chickens, with the aid of a few small chaps from four to eight years of age, can make as much as grown hands can in the field, and this without any expense of gin-house and machinery." "It seems to me a business peculiarly appropriate for the south. We can commence feeding on the 20th of April, (this year on the 16th—last year on the 24th.) We can feed without taking our field hands, or any extra building; and what is done thus is entire gain." In Georgia we are informed to this effect: "One family has made thirty yards of beautiful silk, and has made it up into ladies' dresses, and it is not inferior to the best French or English in appearance." One of the members of Congress from this state also informs us that he has a suit of silk of the manufacture in South Carolina. An experiment is mentioned as commenced in Louisiana, at Baton Rouge, by a gentleman from France, which seems to promise success. The amount of silk cocoons the past year in Tennessee is estimated by one concerned in the manufacture at from 20,000 to 25,000 lbs. In 1840 it is said that there were raised in that state but 1,237 lbs. A fine manufactory here, under the superintendence of an experienced silk-weaver from London, is said to have produced splendid specimens of satin. It is also said that one hundred hands could now be employed in manufacturing the quantity of cocoons produced; and the opinion is expressed that "ultimately no other business will equal it." Governor Jones, of that state, has been presented with a full suit of domestic silk, by the silk-growers there, in acknowledgment of his efficient services to the cause of American industry.

In Kentucky we notice, in one of the journals, that five hundred skeins of beautiful sewing silk have been manufactured in one family; and it is evident that the attention to it is greater than formerly.

Ohio has one of the finest establishments in the country, which manufactures one thousand bushels of cocoons annually, with a capital of $10,000, and employing from forty to fifty hands. The amount of cocoons produced in the Ohio valley is estimated "at least sufficient to keep two hundred reels in operation."

Much attention likewise is paid to the silk business in Indiana; and the success experienced justifies the expectation that the culture of silk will hereafter become a great business there.

In Michigan, Mississippi, and Wisconsin, also, by the accounts given, the attention is more directed to this crop than heretofore.

The whole crop is estimated at 315,965 lbs. of cocoons.

The resolutions passed by the convention at New-York on the subject, express the strongest confidence in the prospects of the silk culture. Arrangements were made for collecting a fuller account of the state of the business the next year, by issuing a circular embracing a great variety of items; the results of which effort will, doubtless, be more cheering than any heretofore attempted. More than one hundred and fifty witnesses have given their testimony, which is embodied in the pamphlet to which reference has already been made. The questions which were put and answered for the convention, related to a great variety of particular points connected with the culture and manufacture of silk. Some of the results it may be well to notice at this time.

1. *Varieties of the mulberry tree.* The Canton, Brosa, Alpine, Italian, multicaulis, and common white mulberry, are all mentioned, and preferences are variously expressed. The Canton seems to be quite a favorite in the state of Massachusetts, and the northern climate generally. The silk worms are stated by one person to leave the other varieties for the Canton. The soil and climate are said to be "peculiarly adapted, and more congenial" to its growth "than even China, its native soil," as remarked by Dr. Parker, missionary to China. "The tree grows more in this continent than in China. It is said there to attain only about four feet in the season, while in our country it grows six to eight feet in a season, after being headed down in the spring, and growing in a dry soil enriched by the decomposition of the foliage on its surface." "I do not know," says one who has great experience, "of any compost so enriching as the foliage of the Canton mulberry." In the middle and western states the Italian and multicaulis seem to be preferred, while some judges seem to think very highly of the white mulberry. One, whose opinion is entitled to much weight, says: "I cultivate them as I do corn, and replant the multicaulis every three years." The mode of planting is of considerable importance. In a trial made by one of the most ardent friends of the cause, after laying his trees "the whole length in the furrow, manuring them with a cheap compost made principally of peat wood properly prepared," they were destroyed by the frosts of winter; but on being "*set deep, one root* in a place, in dry, sloping land, (or ridged, if flat,) rich enough to make good extended roots," the plants went safely through the winter. Thus managed, he says, "they are essentially safe from the perils of winter anywhere between Canada and the gulf of Mexico." It is not the degree of cold that does the injury in this and similar cases, but "freezing and thawing." "Trees, too,

ought not to be so thick as to prevent the sun from reaching their leaves, and the air to circulate freely among them."

2. As regards the *kinds of worms*, the preference is very decidedly given to the peanut variety, and next to the sulphur. The sulphur are larger than the other. One person mentions that in a trial he made, he found that it took four thousand four hundred peanut cocoons, or two thousand two hundred of the sulphur, to make a bushel. The former gave twenty-two ounces, and the latter fourteen ounces of raw silk. The peanut bushel weighed fifteen pounds—the sulphur nine and a half pounds; and it took three hundred peanuts, or two hundred and forty sulphur, to weigh a pound. The four thousand four hundred peanut gave twenty-two ounces, and the four thousand four hundred sulphur twenty-eight ounces of raw silk. He says he generally obtains one hundred pounds of cocoons from an ounce of eggs. The number of cocoons for the pound varies from two hundred up to four hundred: the peanut variety is said to require three hundred. By another, the peanut is said to take four thousand to make a bushel weighing fourteen pounds; of the Nankin peanut three thousand six hundred, weighing thirteen pounds; and of the mammoth sulphur three thousand, weighing ten pounds nine ounces. The thread of the silkworm has been found to be from eight hundred to nine hundred yards on a single cocoon.

3. The *causes of failure* in raising the silkworm are generally attributed to the want of ventilation, as one writer remarks: "The failures in feeding, that came under my observation, in a proportion of ninety-nine to one hundred, have been for the want of sufficient ventilation." Another says, "I consider the *diseases* of silkworms to be produced by vicissitudes in the weather operating upon the moist effluvia from the worms and the litter. The remedy is the free circulation of air, and the free use of lime." Again, another observes: "I have seen all the diseases that the silkworm is subject to; and I believe the nearer we get them to a state of nature the greater the success." Another likewise says: "I am more convinced than ever that water does not hurt the worms. I believe if I had sprinkled my leaves with water this season, when the weather was very dry and hot, I should have saved my worms." And yet another: "I am inclined to think the cause of failure in many, perhaps in most cases, where the multicaulis is used for feeding, arises from using leaves that have not sufficient growth or thickness, and are not ripe. The young and under leaves have not sufficient nutriment, or in other words, not *sufficient material* to produce silk. The worm fed on such leaves passes through its various and wondrous changes, lives the time prescribed by nature for its existence, then either stretches itself out and dies, or winds a thin indifferent cocoon, because it has not

silk *enough to wind a better.*" "I consider unslaked lime a powerful disinfector of disease among silkworms; and very (I would say absolutely) necessary to be used in warm weather." In another case, when the worms were dying by thousands, of the yellows, they were put out; and, says the informant, "I let it *rain on them two days and two nights*; let them dry, covered them with lime, and they commenced eating." The use of lime in another case is mentioned with success in staying the disease. The remark is made in another communication: "Some of my worms this season were wet by the rain leaking through the roof, but I could not see that they were injured by it. Care was taken, however, to dry their food in rainy weather as much as possible." Another recommends that, if attacked by the yellows, they should be placed in the open air.

4. As respects the *mode of feeding*, there are several points very clearly established; that the practice of feeding in the open air, or *open feeding*, (as it is termed,) *early* feeding, in contrast of *late* feeding, and, in most climates, the *one crop system*, are important particulars to be regarded. The following remark is made in a communication from Vermont: "And now I have come to the conclusion that these three things are indispensably necessary for the successful culture of silk: 1. *Plenty of feed*—it matters not so much what kind, whether white or multicaulis; 2. *Plenty of fresh air*; and last, though not least, *cleanliness and plenty of room*. And with them there is no more difficulty in raising silk, than there is in raising sheep or pigs." Another from the same state says: "The worms were fed in *an open building*—so much open, that the wind would frequently blow the leaves from the shelves where the worms were feeding." The testimony on this subject is almost universal. One says "I have found, on close observation, that nothing imparts such vigor to the worms as a good dry breeze of air. A most excellent authority, with reference to this subject, speaking of his own experience, says: "The result of the whole is, in my judgment, *the more air the better*; only guarding against sudden gusts of wind, that will disturb your leaves or bushes. As to ordinary turns of cold weather in our summer months, their effect is to render the worms torpid. Of course, they will not, in this state, eat and grow; and there is loss of time in getting them through; but this is the only loss to be apprehended. Upon returning warmth, they revive and go on with their wondrous labors, apparently uninjured by their temporary interruption." It is also said: "We think there is a decided advantage in using finely-chopped leaves the first two or three weeks—the whole leaves appear to smother the worms." A correspondent from Mississippi remarks: "This season I fed worms with leaves well wetted with dew—so much so, that shaking them on the floor would pretty well sprinkle it, which we generally did,

Heretofore, we gathered dry leaves in time, or even wiped them dry; but it was so tedious, we resolved merely to shake the water off, and our worms grew apparently more rapid than they ever had before. As a fact to prove this, they began to wind the twenty-fifth or twenty-sixth day." An experienced hand mentions that, particularly at the time of moulting, it is very necessary to avoid disturbing them by noises or sudden starts—such as throwing their food on them, or loud talking and laughing, &c.—as it injures them. A similar universal testimony is given in favor of *early feeding*. The *one crop system* is likewise very generally approved, though a number of crops are successfully raised in the warmer climates. By the use of Gill's feeding and ventilating cradle, and the tent system, it is said the expense is lessened one-half, while the amount produced is double. As to the *kind of wood* to be used for the winding, one person remarks that, after a variety of experiments, he found the bass wood the best of the whole; "the leaves are large and do not curl much; and, by setting them up close, the worms will crawl in between the leaves, and deposit their cocoons frequently four or five on a leaf, so that it is very easy gathering them. The floss comes off very clean; and, there being plenty of room, there are very few double ones." Another recommends paper, folded in a fan-like shape, suspended over the worms—the wide-spread part within their reach. Small bundles of straw of about the size of the wrist, crumpled and bent so as to stand out, spread out *downwards*, tied within the feeding frames, near the lower end, are said to be excellent for the purpose.

5. In regard to *the method of preparing silk* for the manufacturer, the following considerations are deemed of importance: A silk-dyer says: "Most people clean the silk with soft soap—destroying the native gloss in freeing it of its gum, owing to the vegetable alkali the soap contains. Many dyers use nothing but the best of white soap. About twenty-five pounds of good white soap dissolved in sufficient clean soft water, is used for one hundred pounds of silk; put the silk loosely in thin bags, boil gently two and a half hours, cool and wash it well in a running stream, and beat occasionally to free it from all impurity." The Piedmont reel seems to be considered the best of any of the reels in use, and great consequence is attached to a uniformity of reeling. One who had great experience on these subjects remarks: "While on the subject of reeling, perhaps I shall be excusable for mentioning what, to me, proves a source of deep regret. I mean the inexperience of those in different sections of our country, who reel their own silk without knowing the necessity of its being done in a particular manner to suit the manufacturer. Lots of silk are offered for sale, which, to look at it, appear perfectly good; but, on examination, are not saleable at any price, because they cannot be worked." Another, also, alluding to the same thing, says: "Raw

silk must be reeled only in large quantities, of a uniform quality and fineness, in order to be employed in manufactures." "The proper business of families, and the only business adapted to them in the silk culture, is the feeding of worms and the production of the cocoons." Again : a gentleman well versed in the business of silk, asserts that "two reelers shall each take one bushel of the same parcel of cocoons, and one shall produce from her portion a pound of silk worth $6 ; while the other shall produce the same quantity worth only $3—the latter being not even the value of the cocoons before she began to reel them." The establishment of filatures in great central points, which shall furnish a near market to those who grow the cocoons, is most desirable. Already there are a number in successful operation.

6. The *manufacture* of silk has been carried to great perfection. It is said : "A large establishment in Baltimore manufactures immense quantities of silk and worsted vestings, employing some fifteen or twenty Jacquard looms, and working up large quantities of domestic silk ; and yet they dare not let it be known that their goods are manufactured in this country." But there are other manufactories in various parts of the country which furnish sewing silk, fringe, tassels, gimp, satin, velvet, and other silks. The uniform testimony of those employed in these establishments, (some of whom have followed the business for twenty or twenty-five years in England,) is, that they never saw finer, or as fine silk, as the American when carefully prepared. It is said to give a stronger thread than foreign silk, and, by many manufacturers, is altogether preferred. The experiment of making paper from mulberry leaves, which is said to have been successful in France, is to be fully tried in this country the present year. It is said that a discovery has been made that pongee silk is produced from the fibrous bark of the mulberry, and that it has never passed through the silk worm. It is also said, on the same authority, that "there is nearly one hundred per cent difference in the use of foilage in raising cocoons. That, to produce one hundred weight of cocoons, from twenty to twenty-two hundred weight of foilage of grafted trees, propagated by grafting buds, cuttings, or layers, is necessary ; while from twelve to thirteen hundred weight of leaves from seedlings will accomplish the same result."

The *profit and feasibleness* of the raising and manufacture of silk are also fully established. One person, who produced raw silk, says that his net profit was equal to $60 per acre. At a large establishment in Massachusetts, the profits are estimated at thirty-seven and a half per cent. To show the kind of manufacture, and the amount of capital invested, and nature of expenses, we insert the following account with reference to a fine manufactory in Ohio : "My factory is in full and successful operation, producing more goods than at any time previous. Our operations, as per

factory books, and account stock taken August 8th, for the past sixteen months, is as follows, in a condensed form, viz :

Cash value of factory buildings,	$1,340
do do machinery, engine, and permanent fixtures,	4,060
1,067 bushels cocoons purchased,	3,600
280 pounds reeled silk purchased,	1,400
Contingent expenses, &c.	604
Wages paid factory hands, &c.	3,152
Dyeing, dyes, &c.	607
Wages paid weavers,	1,610
8,000 bushels of coal, at five cents,	400
	$16,773

In buildings,	$1,340
In machinery, &c.	4,060
Manufactured 3,731 yards of velvets, vestings, dress, and other silks, &c.	6,324
1,006 cravats and handkerchiefs,	1,396
850 pairs of gloves and stockings,	875
70 pairs of shirts and drawers,	325
10 pounds of sewings,	100
Contingent credits,	1,000
Cocoons, reeled and other prepared silk, warps in looms and other stock, coal, &c., per invoice,	3,180
	$18,600

7. As to *the adaptation of our country for the object*, the evidence is equally clear. An able advocate of the enterprise remarks that "the climate of our country approximates closely to that of China in the same parallels of latitude; our geographical position is similar to that country; the boundaries of our land and sea are like theirs; and our prevailing winds in summer are like their land winds. The dry warm atmosphere of both countries in seasons is well adapted to the growth of silks; in fact, (to say a great deal in a few words,) this and China are the only legitimate silk growing countries. In Europe artificial means can only give to the eggs the forwardness which the atmosphere here gives. Throughout Europe the question is, 'How shall the eggs be hatched?' Here it is, 'How shall they be kept back until we are ready for them?' England may compete with us in the manufacture of silk, but she can never grow a pound." "All that is needed is the enterprise and industry of the people of the country, to bring silk into the list of American staples." Another says: "I fully believe that this precious and invaluable product may be cultivated anywhere and everywhere in our extended country and

continent wherever our favorite Indian corn can be grown." Another also: "I cannot doubt that the business is destined shortly to become a great and important branch of national industry, and a vast and inexhaustible source of national wealth." Another still, remarks: "Our experience is, that the silk culture is much the most profitable of any branch of husbandry in this section of country; and we feel confident that it will, ere long, spread through the Union, and become second to none except the cotton growing interest, even if it does not take the lead of that also." "It may be associated with the farming business of the country; and females and children can attend to it, so that it may be carried on without interfering with either domestic or agricultural concerns; while they will give at little expense a very considerable added profit." In France, ladies have done much in this enterprise. It is to be hoped that the whole country will soon be led to awake to the importance of the subject; and that, instead of silk being found among our list of imports, it will, ere long, occupy a place among the staples exported to our foreign markets, and producing additional wealth to our extended country.

[From the last Report of the Comr. of Patents.]

WATER-ROTTING HEMP.

The subject of hemp, in all its management, is one of decided interest throughout the west. At present, Russia furnishes most of the hemp for our navy; not because it grows more luxuriantly, or that the fibre is better than the growth of this country, but because it is better prepared for manufacturing than in this country. It is to the interest of the farmer, manufacturer, and the nation, that we produce at least enough for our own consumption; and what we lack is mainly in the mode of rotting and cleaning. It is decided, by universal experience, that water-rotted hemp is better for perhaps every purpose than dew-rotted. The communication from the pen of the Hon. H. Clay, here annexed, contains most valuable information; and we ask our many readers to give it a careful perusal, and endeavor to put themselves in possession of the advantages afforded.

Ashland, May 28, 1843.

Dear Sir—I received your letter, requesting information as to my method of preparing my water-rotted hemp for market. I water-rotted last winter and this spring, eight or ten tons, in vats fifty feet long, twelve feet wide at the bottom and fourteen at the top, and four and a half feet deep. The hemp is first put in the vats carefully, the water then introduced, and when the hemp is

sufficiently rotted the water is let off. It is very buoyant, and requires great pressure to keep it immersed in the water. It did not succeed well at first, and I am not now entirely satisfied with my contrivance. Weights of logs or stones, or both, will answer; but are inconvenient to remove. I think the best plan will be to sink posts at the distance of six or eight feet apart on each side of the vats, but along side of them. At the bottom let there be hooks in the posts, on which should be laid a log or beam, and then cover them up with earth to the top of the vats. At the top of the posts let there be also hooks, to receive logs passing across the vats from one post to the opposite post. I know that this arrangement, if properly executed, will keep the hemp down in the water.

The length of time of the immersion of the hemp depends upon the temperature of the water; it will remain in cold water six or seven weeks; whilst in very warm weather six or seven days, or less, will be sufficient. You can only determine when the hemp is sufficiently rotted by experiment—taking out a handful, and, when dry, applying it to the brake; but you will soon learn to decide on that point.

When the hemp is rotted enough, it should be spread on the ground to dry—or, which is better, on short grass. If it be not sufficiently rotted, the process may be completed by the rain and dew, without injury. After it is rotted sufficiently, it is broken out in the same old method that has long been practised with dew-rotted hemp. There are now in progress in my neighborhood various experiments to save labor, by breaking out hemp with horse power; some of which, I think, will succeed.

I am not yet able to inform you of the best mode of handling and preparing the article for market. I have just sent (for the first time) three or four tons to the eastern market, as specimens; and I shall know what is the best method when I hear how they are received. I had the hemp put in bales of two or three hundred weight, pressed by a powerful screw, and covered and tied up with cotton bagging. One parcel was hackled so much as to take off one-fourth in tow, but this tow is not lost; the other parcel I sent off as it came from the brake, clean, and divested of showers.

I intend to engage more extensively this year in water-rotting my crop, and I am very sanguine of success. American hemp, as prepared, is undoubtedly as good as Russia hemp.

Wishing you great success in your enterprise, I am, respectfully, your obedient servant.

H. CLAY.

Bernard Myers, Esq.

THRIFT, OR NOTHING IS USELESS.

FROM THE GERMAN OF ZSCHOKKE.

John Schmid was an old soldier with a wooden leg: he was so poor, that for some years he was obliged to solicit alms from door to door in the villages near to that in which he lived, which was situated on the lake of Constance. Now, however, old John Schmid sits at his ease in his arm-chair; he is in independent circumstances; yet few people guess how he came by his wealth. One affirms that he discovered a secret treasure; others have gone so far as to hint that he made a compact with the Evil One. When such hints are dropped in my presence, I fail not to reprove the speakers. I know better the means by which the old soldier got rich, and I will tell you how it was.

John Schmid had three sons, whom he had brought up well in spite of his poverty; for he not only furnished them with good advice, but with a good example, and suffered many privations that he might send them to school. One morning in spring, as the old man was dividing amongst them the bread which was to break their fast, he said, 'My children, you are now old enough to gain your own livelihood; but you must not beg while there are other means of obtaining it—that would be taking bread out of the mouths of those who may want it more than you. Pierre,' he continued, turning to the eldest, 'you are fourteen years old, and have sharp eyes—use them to seek employment. You, Gabriel, though a year younger, have strong arms, set them to work. You, George, though only eleven, have stout legs, profit by them.'

'But what,' exclaimed the three boys at once, 'would you have us to do?'

John Schmid answered, 'I know that you have neither land to cultivate, wood to fell, nor flocks to tend; but there are many things that are thrown away as useless, but which with a little industry may be collected and made profitable. By and by I will show you how. Do not spend the money which you will earn in obedience to your wants, but economise it for the necessities of the future, be it ever so little. Could you save only a batz a day, each would amass at the end of the year, twenty-four florins.'

Upon this John Schmid set about showing his sons how they might earn their bread. He desired them to go in different directions to collect the following articles: first, bones, the largest of which they could sell to the turners, who made them into various useful and ornamental articles, while the smaller were required by farmers for manure. Secondly, pieces of broken glass, to be disposed of to the glass-workers for recasting. As it was spring, he

charged them to get together all the rose-leaves and elder-blossoms which fell in their way, and for which apothecaries give good prices. He also reminded his sons, that by a little inquiry, the chemists would point out what other plants and roots they required. Upholsterers would purchase cows' hair, saddlers, coachmakers and chairmakers, horse-hair. Besides these articles, he mentioned rags for paper-makers, bristles for brush manufactures, quills, pins, hedge-wool, bird-weed, and several other things which might be turned into money, with no other trouble than that of seeking out and collecting them.

The sons did as they were desired, under the guidance of their father. During the spring and summer they collected and sold with such success, that their profits daily augmented.

When autumn came, they sought things of a different kind. Wherever they could obtain permission, they gathered wild fruits, some of which could be made into vinegar and other useful articles. From the woods they obtained quantities of acorns and the seeds of other species of trees, for which they obtained a good price, sometimes from foresters, at others from grain-dealers. They also got together heaps of horse-chesnuts, and took them to the mill to be ground. The miller thought they were going to eat this bitter flour, and made himself merry at the expense of their curious taste; but John Schmid's sons let him laugh, and took their horse-chesnut flour to the book-binders, card-board-makers, and others who make use of paste, the glutinousness of which it increases. Immediately after a warm shower, the young Schmids sought for mushrooms, which they sold to the epicures in the neighborhood.

Having saved a quantity of birch twigs, rushes, and osiers, the old man and his sons occupied the winter months in making brooms, chair-bottoms, and baskets, so that their cottage appeared both like a warehouse and a workshop. In this way the spring returned, and old John Schmid thought it advisable to see what had been gained during the year. On opening the box in which the cash was deposited, he found that each of his three sons had contributed more than a batz a day of savings, for the money-box contained one hundred and four florins and twenty-three kreutzers. At the sight of the hoard the sons were delighted, for they had never before seen so large a sum at once. John Schmid immediately carried the money to a wholesale tradesman in a large town, and deposited it with him at interest.

John Schmid, now no longer a beggar, employed himself solely in helping his sons sell off the merchandize they had collected. This went on for four years, during which the family had amassed six hundred and fourteen florins! As, however, their riches increased, the young men grew independent in their manners, and disputed amongst themselves; one accusing the other of not work-

ing hard enough, of selling too cheaply, or of extravagance in treating himself to a cup of wine rather too often. Poor old Schmid!—do all he could, he was unable, on some occasions, to settle these discussions. Nothing seemed likely to cure the evil but separation; and addressing his sons, he said, 'Take each of you one hundred florins, and seek your fortunes in the world; industry and economy always prosper. The rest of the capital shall remain in the hands of the banker, in case that any unforeseen misfortune should fall on any of us so as to need it. But while it remains untouched, the interest will be added to the principal.' To this the young men agreed; and taking each his apportioned sum, bade adieu to their father. They took their departure, each in a different direction. Pierre went eastward, Gabriel westward, and George towards the south. John Schmid grieved to part with his children, but he knew it was for their good, and bore his regrets in silence.

Years rolled on. John Schmid grew old and weak, but he would not touch a kreutzer of his children's capital. At length he fell ill; and some of his neighbors, pitying his lonely state, sent him relief; others declared they had poor enough of their own to support, and though he had lived in their village for twenty-one years, threatened to send him away as a stranger. Upon this old John wrote to the merchant who held the money, saying, 'Send me three hundred florins of the capital I deposited in your hands; for I am aged and weak, and for fourteen years I have not heard of my children. Doubtless they are dead. It will not be long ere I follow them to the grave.'

The honest merchant promptly replied to the old man's demand. 'I return you,' he wrote, 'the sum you ask. The balance remaining is perhaps greater than you imagine. It has increased, by little and little, to more than one thousand florins.'

When the money arrived, the peasants stared with wonder, and declared that John Schmid must be a conjurer. But the old man himself, in spite of his riches, was unhappy. He wished to join his sons, whom he thought to be no more. He would often exclaim, 'I shall die in solitude; no son is left to close my eyes. However, he recovered from his illness, and it was destined that he should not die alone.

One Sunday evening he was seated with other peasants under a linden tree, when a servant on horseback rode up, and inquired if any one could direct him to the cottage of John Schmid? The villagers, full of astonishment, replied, 'You need not seek him in his house for he is here.' As they stared and whispered inquiries to one another as to what was to come next, two handsome carriages entered the village, and stopped before old Schmid's door. Three well-dressed gentlemen and two ladies descended from the coaches, and as old John made his appearance, threw themselves

successively into his arms. 'My dear father,' said the eldest, 'can it be possible that you have forgotten us? I am Pierre. I have become a wholesale grocer at Varsovie, in Poland, and this lady is my wife.' Then the second spoke :—'I am your son Gabriel, and also bring you a daughter-in-law. I, too, reside at Varsovie, and deal in corn.' Presently the third son came forward. 'I,' he said 'am George. I have recently returned from India, where I made a fortune by commerce. Seeing by the Gazettes that my brothers were in Poland, I joined them, and we all agreed to travel hither to seek you, and to make you happy for the rest of your life.' Poor John Schmid was quite overcome, and shed tears. He invoked blessings on his children. 'To you,' exclaimed one of them 'we owe all our good fortune. Had you not taught us that nothing, be it ever so despised, is useless—had you not made us industrious, persevering and economical, we should still have been mendicants.'

The rest of John Schmid's life was spent in happiness, for one or other of his sons always remained with him. The money, which had accumulated during their long absence, was drawn from the merchant in whose hands it had so much increased, and employed in building a school for the gratuitous education of poor children.

To those who, like me, were aware of the means by which the Schmids grew rich, their rise in the world is known to be the certain result of integrity, industry, and perseverance in turning to account things generally considered useless. Spite, however, of all I can urge, one or two of the most prejudiced villagers shrug their shoulders when John Schmid's name is mentioned, and insinuate that he must have made a compact with a certain nameless person.

SOURCE FROM WHENCE PLANTS DERIVE THEIR INORGANIC MATTER.

M. M. Wiegmaun & Polstorff instituted the following experiments for the purpose of determining the source of the inorganic elements in vegetables. The plants upon which the experiments were made, were the vicia sativa, hordeum vulgare, or barley, polygonum fagopyrum, nicotiana tobaccum, or tobacco, and trifolium pratense. Two kinds of soil were employed; the first consisting of sand in which all the soluble and inorganic matter was removed by heating and dry solutions. The second, a mixture of this sand and the following substances, and in the proportion stated.

Sand,	861.26
Chalk,	10.00
Alumina,	15.00
Oxide of iron,	10.00
Carbonate magnesia,	5.00
Phosphate of lime,	15.00
Oxide manganese,	2.50
Anhydrous sulphate of lime,	1.25
Sulphate of potash,	0.34
Humate of potash,	3.41
Soda,	2.22
Humate of ammonia,	10.29
" lime,	3.07
" magnesia,	1.97
" alumina,	4.64
" iron,	3.32
Humine insoluble in water,	50.00

The plants in the sand were moistened by distilled water, besides being protected from external influences by being covered. Germination, growth, and sometimes flowering took place, but all were stinted and imperfect, and none produced seed. The plants in the mixed artificial soil grew luxuriantly and produced ripe fruit.

In order to determine the elements of the plants which grew in the sand, they were dried and burnt, and for comparison a quantity of seed equal in weight to that which had been planted was also burnt to ashes and its elements also determined by analysis. The results were that the elements of plants which grew in the sand weighed twice as much as those of the seeds sown—while the elements of the ashes of the plants which grew in the mixed soil were twice and a half times greater than those which grew in the sand ; and in the tobaçco plant five times greater. To account for the additional matter found in the plant over and above that originally contained in the seed sown, the sand in which they grew was analysed after being well washed in boiling water. It contained

Silex, or flint,	97.900
Potash,	0.320
Lime,	0.484
Magnesia,	0.009
Alumina,	0.876
Oxide of iron,	0.315

The same sand was then exposed to water during a month, through which carbonic acid continually passed. The solution was then analysed, when it was found to contain silica, potash, lime and magnesia. To prove that the additional matter of the

plants over and above that contained in the seeds sown, M. Wiegmann sowed seeds of cresses in fine platinum wire, in a platinum crucible, and watered them with distilled water. They grew well, but the ashes of the cresses contained only the same weight of inorganic matter as the seed which had produced them, a result which it will be seen, differed from that of plants growing in the sand, which contained at least twice as much inorganic matter as the seed from which they were grown. The sand used in this experiment was not pure silex or quartz, but a soil probably derived from granite, but from which not only all the vegetable matter had been removed by ignition, but all the free lime and alkalies by acid and full washing afterwards by water.

The results of these experiments go to prove,

1st. That inorganic matter is essential to the perfect plant, as no fruit was produced where it was totally wanting or even deficient in quantity.

2d. That plants by their roots possess the power of decomposing the compound of inorganic matter, as in the experiment with the sand from which all the free soluble matter had been removed as stated above.

3d. That the opinion which has been advanced by some physiologists that the elements may be formed in plants, is incorrect, as is shown by their absence in the cresses which grow in the platinum wire.

It is supposed, however, that all the inorganic matter is not necessary to the perfection of the plant, but that some elements may be substituted for others, as soda for potash, magnesia for lime, &c.

NEW BOOKS.

The Farmer's Manual, a practical treatise on the nature and value of manures, &c. By F. Falkner, Esq. To which is added, Productive Farming, by Joseph A. Smith. D. Appleton & Co. N. Y. G. S. Appleton, Philadelphia.

These two works in one volume contain much practical information for the farmer. The object of the first work, as stated in the preface, is "to explain the nature and constitution of manures generally, to point out the means of augmenting the quantity and preserving the fertilizing power of farm-yard manure, the various sources of mineral and other artificial manures, and the causes of their frequent failure."

The second part is a compilation from the various agricultural writers of the present day. We give below an extract from *the first* on the management of manures.

"We have already said that plants in a dry state, such as straw, hay, &c., consist of carbon, hydrogen, and oxygen, a very small portion of nitrogen, and of about six parts in 100 of alkaline and earthy salts; and that the former elements are placed, by the operation of the vital principle, under a different arrangement with regard to each other from that which their chemical affinities give them a tendency to assume.

The combustion or burning of vegetable substances is nothing more than a rapid and violent action of those affinities or attractions, in which oxygen plays the principal part. When they are heated to a certain degree, both the oxygen of the air and that already contained in the substance are brought into action, and the result will be easily understood from what has been previously stated of the nature of the elements concerned. The oxygen unites with the carbon to form carbonic acid gas, and with the hydrogen to form water, while a small portion of the hydrogen unites with nitrogen to form ammonia, or (though subject to some doubt) passes off uncombined. Carbonic acid gas is the most abundant of these products, water the next in quantity, and ammonia by far the least. These all escape as gases, and the ashes that remain consist of some or all of the oxides, or bases, before described, united with some or other of the mineral acids—as alkaline and earthy salts, which differ very much, both in kind and quantity, according to the plants from which they are derived. As these salts, or mineral substances constitute an essential part of all plants, they are themselves capable of acting powerfully as manure. The most valuable, and generally the most plentiful of them, are the salts of potash, and the phosphates of lime and magnesia; not that the other salts contained in ashes are less essential; as, for instance, muriate of soda (*common salt*) and sulphate of lime (*gypsum*,) but because the latter are more liberally supplied to the soil by the hand of nature.

If, instead of being burnt, plants are accumulated in heaps exposed to the weather—

as in a dung-yard—a similar action to burning, though of slower operation, takes place; which indeed may be called a tardy combustion, in which the elements of the water present take an active part. The greater portion of the carbon, hydrogen, and oxygen, with nitrogen, are thus dissipated; the sulphates and phosphates are decomposed, producing stinking gases; and if in the mean time water be allowed to soak through the mass and drain away, it carries with it the soluble salts, ultimately leaving a black mass, consisting chiefly of carbon, with a small quantity of hydrogen and oxygen, and some insoluble earthy salts. If, therefore, decay be allowed to proceed to its greatest extent, it produces a much worse effect than absolute fire; inasmuch as almost all the soluble salts are lost. Vegetable matter reduced to this state is *humus*, or that black vegetable matter contained in all rich soils, and those of old pasture land. The only difference is in the mode of their production, the one having been produced by the decay of plants on the surface, and the other from the decay of the roots and leaves of plants both above and beneath the soil. They operate in the same way in the nourishment they yield to plants, namely, by the salts they yet retain, by attracting moisture and ammonia from the atmosphere, and by slowly yielding carbonic acid gas to the roots of the growing crop.

If the quantity of water which mixes with the heap be limited, it is often evaporated by the heat produced by the fermentation; the chemical action in a great measure ceases; and the heap, when opened, exhibits that appearance which is commonly called "*fire-fanged.*" When in that state, it will be found to have lost more than one-half of its value; but, if due care be taken to regularly mix the layers of dung, without too much intermixture of horse-litter, there will be no danger of the dung made by the cattle in the yards being overheated by fermentation, even in the warmest weather. Should that danger, however, be apprehended, an addition of road-scrapings, or earth of any kind, will prevent it; and, in the winter, the cleanings of the cow-house, as being of a cold nature, will answer the purpose.

When plants and their seeds are consumed by animals, nearly half their weight in a dry state is given out from the lungs and by perspiration from the skin in a gaseous form, chiefly as carbonic acid gas and water, with some ammonia; the remainder of their substance, together with the effete, or dead matter of the animal organs, are rejected, as dung and urine, except that portion retained as nourishment by growing and fatting animals. The *solid excrement* contains the woody fibre, the insoluble animal matter and salts, and the *urine*, the more soluble salts and substances rich in nitrogen. If no care be taken of the urine, and it be allowed to run about the yard, it soon putrefies—its nitrogen flies off in the shape of ammonia; its salts are carried away by every shower of rain; and, although a portion of it may be saved by its mixture with the dung of the cattle, yet the greater part of its valuable contents are evaporated by the action of the atmosphere. If it be allowed to drain into a tank or other receptacle, it there also rapidly undergoes putrefaction; and, if this be not checked, a considerable part of the ammonia produced will escape with the sulphur and phosphorus, resulting from the decomposition of the salts containing those substances: occasioning the intolerable stench observed in such cases. Now the ammonia, and the alkaline and earthy salts, are by much the most valuable part of farm-yard or stable dung, and the former is always more abundant when cattle are fed with corn, oil-cake, and other rich food. Without ammonia no seed could be produced; and without alkaline and earthy salts, neither seed nor plants could exist.

It is the deficiency of some of these substances, where moisture is not wanting, which is the cause of the land producing poor crops; and it is the almost total absence of some, or all of them, which is the cause of complete sterility. Instances may almost every where be found of land which, though abounding in humus—such as heathy and peaty soils—are, notwithstanding, incapable of bearing grain. If the valuable substances above mentioned be wasted in the manner described—which is too often the case, to an enormous extent—the crops will be very deficient; and if to this waste

be added the carrying away of large portions of the produce—as when hay and straw are sold, and no manure returned—the land will soon cease to bear crops. To increase the quantity of manure raised on the land should, therefore, be the constant aim of every farmer: hay should never be sold, unless two tons of stable litter are returned for every load sent off the farm; and, unless the farm contains a large portion of rough pasture, the horse-teams should be kept in the stable, and soiled during the summer and autumn on green food; every portion of apparently refuse vegetable and animal matter should also be carefully collected and added to the dung-heap; and, in this manner, it is inconceivable what additional quantities of excellent muck may be produced. The manure thus made, and not fermented, is generally applied, either in its fresh state, or only partially turned, to clay land fallows which are to be sown with wheat; as being of a colder nature than winter-made dung, it will not occasion the crop to be so hastily pushed forward as to occasion straw instead of corn.

If attempts be made to supply the place of farm-yard dung by *any one salt*, or, in other words, by two or three only of the elements of plants—nitrate of soda, or nitrate of potash, or sulphate of lime *(gypsum)* for instance—it will succeed only where all the others happen to be present on the soil, by the effect of previous manuring; and will inevitably fail where those other needful substances are either absent or very deficient. Now, it is extremely difficult to ascertain in what salt the soil is really deficient; care must, therefore, be taken in the application of artificial manures, that they contain all the elements included in the muck for which they are substituted. These are all usually found, more or less, in the dung-heap; how needful, therefore, is it that the farmer should take good care of that manure produced upon his own land, which certainly contains all the elements of plants, and upon which he knows he can safely rely!

It has been stated before, that the most efficient part of farm-yard dung is that small portion, invisible in the mass, which consists of earthy and alkaline salts and ammonia. The other ingredients which constitute the great bulk of manure, consisting of carbon and the elements of water, are abundantly supplied by the atmosphere to the growing plants, and therefore a loss of these by needless fermentation or neglect is of little importance, were it not that their loss is unavoidably accompanied with the waste of the more essential substances in the manner described. It should be the object of the farmer not only to prevent the waste of such precious substances by every means that knowledge and ingenuity can devise, but also to make every addition to them that nature or local circumstances have placed within his reach.

These desirable purposes he will be the better able to carry into effect when he fully understands the nature of the mauure he has under his management, and by that means he can exercise a sound discretion in adding to its quantity and effect.

Let it not be alleged against any inquiry by the farmer into the constituent nature and chemical properties of his manure, that he has no ideas attached to the several terms used to designate the substances of which it is said to consist. He is obliged to learn the names and uses of the several implements he employs in the cultivation; and upon what principle, we may ask him, should he refuse to make himself acquainted with the names and general properties of the produce he raises? But little effort is required to obtain a precise knowledge of the several elements, or substances at least, by the employment of which he is enabled to raise and increase his crops, and is it not pleasant to learn, as well as most useful to understand, the reason of their value to him? Nor is this limited degree of chemical knowledge of difficult attainment. Every farmer has seen wood ashes, and also seen water poured upon them for the purpose of extracting a something; that substance is chiefly potash, which may be seen by evaporating the clear water, which leaves the alkali behind, and the dregs which remain at the bottom consist for the most part of earthy phosphates—a similar substance to the earth of bones. *Soda* is now so commonly used as to be known at sight to most persons; *lime* and *magnesia* are still more familiar; *ammonia* is the

common pungent salt of smelling-bottles; *sulphuric, muriatic*, and *nitric acids.* are extensive articles of commerce, and, with *phosphoric acid*, may be found at any chemist's shop, and these acids, as well as their bases—potash, soda, lime, and magnesia—may be had for a trifle, either separately or combined as salts. When, therefore, the appearance and more obvious qualities of these several substances have become familiar, their efficacy as manure may be proved, by mixing them thoroughly with two or three hundred times their weight of mould, and applying the compost to garden plants. The farmer might in this easy way soon become acquainted with the name, character, and properties of the invaluable substance contained invisibly in the muck of his yards; and would be the better able, and more desirous, to prevent their stealing away from him."

LECTURES ON THE APPLICATION OF CHEMISTRY AND GEOLOGY TO AGRICULTURE: By Jas. F. W. Johnston, M. A. F. R. S. Published by Wiley & Putnam, New-York. Price 31¼ cents.

This is part the fourth of this series of Lectures, which we have hailed with great pleasure, as they have successively appeared. These are decidedly the greatest addition that has yet been made to the Farmers' Literature, written in a manner that makes them entirely comprehensible to any one who reads them. This part is "On the products of the soil, and their use in the feeding of animals." The following extract will give a good idea of the work, and will be interesting to those engaged in raising and fattening animals:

OF THE KIND AND QUANTITY OF ADDITIONAL FOOD REQUIRED BY THE FATTENING ANIMAL.

"In the animal which is increasing in size or in weight, the food has a double function to perform. It must *sustain* and it must *increase* the body. To increase the body, an additional quantity of food must be consumed, but the kind or nature of this additional food will depend upon the kind of increase which the animal is making or is intended to make.

One of the important objects of the stock farmer is to make his full grown animals lay on fat, so that they may as quickly as possible, and at the least cost, be made ready for the butcher. To effect this object, he adjusts the kind and quantity of the food he gives, to the practical object he wishes to attain.

We have already seen reason to believe, that the natural and immediate source of the fat of animals is in the oily matter which the food contains. If we wish only, or chiefly, to lay on fat, therefore, we ought to give some kind of food which contains a larger proportion of fatty matter than that upon which the animal has been accustomed to live. This is what the practical man has actually learned to do. To his sheep and oxen he gives oil-cake or linseed oil mixed with chopped straw, to his dogs cracklings,* to his geese and turkeys Indian corn, which contains much oil, and to his poultry beef or mutton suet.

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* Cracklings are the skinny parts of the suet from which the tallow has been for the most part squeezed out by the tallow chandlers. Might cattle not be fattened upon cracklings crushed and mixed with their other food? Might not some *cheap* varieties of oil also be mixed with their food for the purpose of fattening.

Many experiments are yet wanting to determine with accuracy the proportion of fat contained in all the different kinds of food usually consumed by animals. Nearly all we yet know upon this subject is exhibited in the tabular view of their composition to which I have already directed your attention on page 531.

One thing, however, of considerable practical value has been recently ascertained, —that the oily matter of seeds exists chiefly near their outer surface—in or immediately under the skin or husk. This fact is shown in the case of wheat, by the following results of the examination of two varieties of this grain, one grown near Durham, the other in France. The result as to the French grain is given by Dumas :

PER CENTAGE OF FATTY OIL.

	English.	*French.*
Fine flour	1.5	1.4
Pollard	2.4	4.8
Boxings	3.6	—
Bran	3.3	5.2

This fact of the existence of more fat in the husk than in the inner part of the grain, explains what often seems inexplicable to the practical man—why bran, namely, which *appears* to contain little or no nourishing substance, should yet fatten pigs and other full grown animals, when given to them in sufficient quantity along with their other food. It also explains why *rice dust* should be found to fatten stock,* though the cleaned and prepared rice contains but little oil, and is believed, therefore, to be unfitted for laying on fat upon animals with any degree of rapidity. No doubt the dust from pearl-barley and from oats, as well as the husk of these grains, might be economically employed by the stock feeder where they can readily be obtained.

KIND AND QUANTITY OF ADDITIONAL FOOD REQUIRED BY A GROWING ANIMAL.

The young and growing animal requires also that its food should be adjusted to its peculiar wants. In infancy the muscles and bones increase rapidly in size when the food is of a proper kind. This food, therefore, should contain a large supply of the phosphates, from which bone is formed, and of gluten or fibrin, by which the muscles are enlarged. Some kinds of fodder contain a larger proportion of these phosphates. Such are corn seeds in general, and the red clover among grasses. Some again contain more of the materials of muscles. Such are beans and peas among our usually cultivated seeds, and tares and other leguminous plants among our green crops.

Hence the skilful feeder or rearer of stock can often select with judgment that kind of food which will specially supply that which the animal, on account of its age or rapid growth, specially requires—or which, with a view to some special object, he wishes his animal specially to lay on. Does he admire the fine bone of the Ayrshire breed ?—he will try to stint it while young of that kind of food in which the phosphates abound. Does he wish to strengthen his stock, and to enlarge their bones ?—he will supply the phosphates liberally while the animal is rapidly growing.

An interesting application of these principles is seen in the mode of feeding calves adopted in different districts. Where they are to be reared for fattening stock, to be sold to the butcher at two or three year old, they are well fed with good and abundant food from the first, that they may grow rapidly, attain a great size, and carry much flesh. If starved and stunted while young, they often fatten rapidly when put at last upon a generous diet, but they never attain to their full natural size and weight.

When they are reared for breeding stock or for milkers, similar care is taken of them in the best dairy countries from the first, though in some the allowance of milk is stinted, and substitutes for milk are early given to the young animals.

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*Rice dust is very good food for fattening pigs, makes excellent pork, and is very profitable when given along with whey.

But it is in rearing calves for the butcher that the greatest skill in feeding is displayed, where long practice has made the farmers expert in this branch of husbandry. To the man who has a calf and a milk cow, the principal question is, how can I, in the locality in which I am placed, make the most money of my calf and my milk? Had I better give my calf a little of the milk, and sell the remainder in the form of new milk—or had I better make butter and give the skimmed milk to my calves—or will the veal, if I give my calf all the milk, pay me a better price in the end? The result of many trials has shown, that in some districts the high price obtained for well fed veal gives a greater profit than can be derived from the milk in any other way.

While the calf is very young—during the first two or three weeks—its bones and muscles chiefly grow. It requires the materials of these, therefore, more than fat, and hence half the milk it gets, at first, may be skimmed, and a little bean meal may be mixed with it to add more of the casein or curd out of which the muscles are to be formed. The costive effect of the bean meal must be guarded against by occasional medicine, if required.

In the next stage, more fat is necessary, and in the third week at latest, full milk, with all its cream, should be given, and more milk than the mother supplies, if the calf requires it. Or, instead of the cream, a less costly kind of fat may be used. Oil-cake, finely crushed, or linseed meal, may supply at a cheap rate the fat which, in the form of cream, sells for much money. And, instead of the additional milk, bean meal in larger quantity may be tried, and if cautiously and skilfully used, the best effects on the size of the calf and the firmness of the veal may be anticipated.

In the third or fattening stage, the custom is, with the same quantity of milk, to give double its natural quantity of cream—that is, to supply in this way the fat which the animal is wished chiefly to lay on. This cream may either be mixed directly with the mother's milk, or, what is better, the *afterings* of several cows may be given to the calf along with its food. For the expensive cream there might no doubt be substituted many cheaper kinds of fat which the young animal might be expected to appropriate as readily as it does the fat of the milk. Linseed meal is given with economy. Might not vegetable oils and even animal fats be made up into emulsions which the calf would readily swallow, and which would increase his weight at an equally low cost? A fat pease-soup has been found to keep a cow long in milk; might it not be made profitable also to a fattening calf?

The selection of articles of food which will specially increase the size of the bones in the growing animal, by supplying a large quantity of the phosphates, is at present limited in a considerable degree. The grain of wheat, barley, and oats is the source from which these phosphates are most certainly aud most abundantly supplied to the animals that feed upon them. But in many cases corn is too expensive a food, and those kinds of corn which contain the largest proportion of the phosphates supply only a comparatively small quantity in a given time to the growing animal. Why should not bone-dust or *bone-meal* be introduced as an article of general food for growing animals? There is no reason to believe that animals would dislike it—none that they would be unable to digest it. With this kind of food at our command, we might hope to minister *directly* to the weak limbs of our growing stock, and at pleasure to provide the spare-boned animal with the materials out of which a limb of great strength might be built up.

Chemical analysis comes further to our aid in pointing out the kind of food we ought to give for the purpose of increasing this or that part of the animal body. Thus in regard to the same growth of bone, it appears that, while *linseed and other oil cakes* are mainly used with the view of adding to the fat, some varieties are more fitted at the same time to minister to the growth of bone than others are. Thus four varieties of oil-cake examined in my laboratory, contained respectively of earthy phosphates and of other inorganic matter in 100 lbs. the following quantities:

	Per centage of Earthy phosphates.	Per centage of Other inorganic matter.
British linseed cake	2.86	2.86
Dutch do.	2.70	2.54
Poppy cake	5.22	1.24
Dodder cake	6.67	3.37

The numbers in the first column, opposite to poppy and dodder cake, show that these varieties of oil-cake contained a much larger proportion of the phosphates than the others did, and consequently that an equal weight of them would yield to growing stock more of those substances which are specially required to build up their increasing bones.

FAMILIAR LETTERS ON CHEMISTRY, AND ITS RELATION TO COMMERCE, PHYSIOLOGY AND AGRICULTURE: By Justus Liebig, M. D. &c.; Edited by Joel Gardner, M. D.—James M. Campbell & Co. Philadelphia.

An interesting series of Letters, by Professor Liebig, on various subjects and sciences, in which is to be found much information. His peculiar opinions are of course very prominent. The Twelfth Letter will be found below.

MY DEAR SIR—Having now occupied several letters with the attempt to unravel, by means of chemistry, some of the most curious functions of the animal body, and, as I hope, made clear to you the distinctions between the two kinds of constituent elements in food, and the purposes they severally subserve in sustaining life, let me now direct your attention to a scarcely less interesting and equally important subject—the means of obtaining from a given surface of the earth the largest amount of produce adapted to the food of man and animals.

Agriculture is both a science and an art. The knowledge of all the conditions of the life of vegetables, the origin of their elements, and the sources of their nourishment, forms its scientific basis.

From this knowledge we derive certain rules for the exercise of the ART, the principles upon which the mechanical operations of farming depend, the usefulness or necessity of these for preparing the soil to support the growth of plants, and for removing every obnoxious influence. No experience, drawn from the exercise of the art, can be opposed to true scientific principles, because the latter should include all the results of practical operations, and are in some instances solely derived therefrom. Theory must correspond with experience, because it is nothing more than the reduction of a series of phenomena to their last cause.

A field in which we cultivate the same plant for several successive years becomes barren for that plant in a period varying with the nature of the soil: in one field it will be in three, in another in seven, in a third in twenty, in a fourth in a hundred years. One field bears wheat, and no peas; another beans and turnips, but no tobacco: a third gives a plentiful crop of turnips, but will not bear clover. What is the reason that a field loses its fertility for one plant, the same which at first flourished there? What is the reason one kind of plant succeeds in a field where another fails?

These questions belong to Science.

What means are necessary to preserve to a field its fertility for one and the same plant?—what to render one field fertile for two, for three, for all plants?

These last questions are put by Art, but they cannot be answered by Art.

If a farmer, without the guidance of just scientific principles, is trying experiments to render a field fertile for a plant which it otherwise will not bear, his prospect of success is very small. Thousands of farmers try such experiments in various directions, the result of which is a mass of practical experience forming a method of cultivation which accomplishes the desired end for certain places; but the same method frequently does not succeed—it indeed ceases to be applicable to a second or third place in the immediate neighborhood. How large a capital, and how much power, are wasted in these experiments! Very different, and far more secure, is the path indicated by SCIENCE; it exposes us to no danger of failing, but, on the contrary, it furnishes us with every guarantee of success. If the cause of failure—of barrenness in the soil for one or two plants—has been discovered, means to remedy it may be found.

The most exact observations prove that the method of cultivation must vary with the geognostical condition of the subsoil. In basalt, greywacke, porphyry, sandstone, limestone, &c., are certain elements indispensable to the growth of plants, and the presence of which renders them fertile. This fully explains the difference in the necessary methods of culture for different places; since it is obvious that the essential elements of the soil must vary with the varieties of composition of the rocks, from the disintegration of which they originated.

Wheat, clover, turnips, for example, each require certain elements from the soil; they will not flourish where the appropriate elements are absent. Science teaches us what elements are essential to every species of plants by an analysis of their ashes. If therefore a soil is found wanting in any of those elements, we discover at once the cause of its barrenness, and its removal may now be readily accomplished.

The empiric attributes all his success to the mechanical operations of agriculture: he experiences and recognises their value, without inquiring what are the causes of their utility, their mode of action: and yet this scientific knowledge is of the highest importance for regulating the application of power and the expenditure of capital—for insuring its economical expenditure and the prevention of waste. Can it be imagined that the mere passing of the ploughshare or the harrow through the soil—the mere contact of the iron—can impart fertility miraculously? Nobody, perhaps, seriously entertains such an opinion. Nevertheless, the *modus operandi* of these mechanical operations is by no means generally understood. The fact is quite certain that careful ploughing exerts the most favoaable influence; the surface is thus mechanically divided, changed, increased, and renovated; but the ploughing is only auxiliary to the end sought.

In the effects of time, in what in agriculture are technically called *fallows*—the repose of the fields—we recognise by science certain chemical actions, which are continually exercised by the elements of the atmosphere upon the whole surface of our globe. By the action of its oxygen and carbonic acid, aided by water, rain, changes of temperature, &c., certain elementary constituents of rocks, or of their ruins, which form the soil capable of cultivation, are rendered soluble in water, and consequently become separable from all their insoluble parts.

These chemical actions, poetically denominated "the tooth of time," destroy all the works of man, and gradually reduce the hardest rocks to the condition of dust. By their influence the necessary elements of the soil become fitted for assimilation by plants; and it is precisely the end which is obtained by the mechanical operations of farming. They accellerate the decomposition of the soil, in order to provide a new generation of plants with the necessary elements in a condition favorable to their assimilation. It is obvious that the rapidity of the decomposition of a solid body must increase with the extension of its surface; the more points of contact we offer in a given time to the external chemical agent, the more rapid will be its action.

The chemist, in order to prepare a mineral for analysis, to decompose it, or to in-

crease the solubility of its elements, proceeds in the same way as the farmer deals with his fields—he spares no labor in order to reduce it to the finest powder; he separates the impalpable from the coarser parts by washing, and repeats his mechanical bruising and trituration, being assured his whole process will fail if he is inattentive to this essential and preliminary part of it.

The influence which the increase of surface exercises upon the disintegration of rocks, and upon the chemical action of air and moisture, is strikingly illustrated upon a large scale in the operations pursued in the gold mines of Yaquil, in Chili. These are described in a very interesting manner by Darwin. The rock containing the gold ore is pounded by mills into the finest powder; this is subjected to washing, which separates the lighter particles from the metallic; the gold sinks to the bottom, while a stream of water carries away the lighter earthy parts into ponds, where it subsides to the bottom as mud. When this deposit has gradually filled up the pond, this mud is taken out and piled in heaps, and left exposed to the action of the atmosphere and moisture. The washing completely removes all the soluble part of the disintegrated rock; the insoluble part, moreover, cannot undergo any further change while it is covered with water, and so excluded from the influence of the atmosphere at the bottom of the pond. But being exposed at once to the air and moisture, a powerful chemical action takes place in the whole mass, which becomes indicated by an efflorescence of salts covering the whole surface of the heaps in considerable quantity. After being exposed for two or three years, the mud is again subjected to the same process of washing, and a considerable quantity of gold is obtained, this having been separated by the chemical process of decomposition in the mass. The exposure and washing of the same mud is repeated six or seven times, and at every washing it furnishes a new quantity of gold, although its amount diminishes every time.

Precisely similar is the chemical action which takes place in the soil of our fields; and we accelerate and increase it by the mechanical operations of agriculture. By these we sever and extend the surface, and endeavor to make every atom of the soil accessible to the action of the carbonic acid and oxygen of the atmosphere. We thus produce a stock of soluble mineral substances, which serve as nourishment to a new generation of plants, and which are indispensable to their growth and prosperity.

THE AMERICAN POULTERER'S COMPANION: By C. N. Bement. Published by Saxton & Miles. 12mo. 319 pp.

The value of this book is very clearly indicated by the rapid sale of the first edition. We cannot but add our testimony also to its value, after a pretty careful examination of its contents. It is the book which not only every farmer should possess, but also the mechanic, or every one who has a spot of land large enough to accommodate a dozen or two of fowls. In the publication of this work Mr. Bement has certainly performed a very important service to the community, and the subject cannot be considered a small one, when it is known that the value of poultry in New-York alone, amounted, according to the last census, to $2,373,029, and that in the states and territories it amounted to the sum of $12,176,170.

Mrs. Rundell's celebrated Cook Book. A new system of domestic cookery. Philadelphia, Carey & Hart.

Professes to be founded on principles of economy, for the use of private families. It contains 250 pages of directions for cooking, &c., but is quite out of our line of experience, as we are better qualified to pronounce upon the articles after they have gone through the process. The ladies will find abundance in it to practice upon, and all for 25 cents.

The Economy of Waste Manures: By John Hannam, Esq. Philad. Carey & Hart. Price 25 cents.

This is a pamphlet of nearly one hundred pages, on "The Nature and use of Neglected Fertilizers"—written for the Yorkshire Agricultural Society, England, but useful every where.

The Berkshire Jubilee, celebrated at Pittsfield, Mass., Aug. 22, and 23, 1844: Publishers, Weare C. Little, Albany; E. P. Little, Pittsfield.

We do not know how it is, but there are some movements of the mind which bear the impress of inspiration, they are so much like the immediate communications from the Divine Intelligence that we would fain regard them as such; or they possess at least some of those characters which belong to communications which have been made, when men "speak as they were moved." They are, to change the thought a little, immediate perceptions of a beautiful idea, free and spontaneous in its inception, and happy in its end. Such appears to have been the idea of the Berkshire Jubilee.

The book before us relates the sayings and doings of this occasion. The more important of the former consist of a sermon by President Hopkins of Williams college. A poem by the Rev. Wm. Allen, D. D.; and an oration by Joshua A. Spencer. The minor parts of the book consist of speeches and odes, from which we get something of the spirit of the occasion, and not only the spirit of the occasion, but we see in them the strong traits or features which belong to the New-England character. Some may say the character is strongly egotistic, so be it; nevertheless, it is

the egotism we like: we hope it will live. It is the egotism of a sentiment worthy to be cherished, and where it prevails we may be assured also of the existence of a principle coexisting without, which will rally together the same spirit when outward or inward dangers threaten the safety of our country or our institutions. We take the liberty of copying one of the poems by our friend William Pitt Palmer, entitled the "Response of the Home-Comers."

RESPONSE OF THE HOME-COMERS.

"HAIL, Land of Green Mountains! whose valleys and streams
Are fair as the Muse ever pictured in dreams;
Where the stranger oft sighs with emotion sincere,—
Ah, would that my own native home had been here!

Hail, Land of the lovely, the equal, the brave,
Never trod by the foe, never tilled by the slave;
Where the lore of the world to the hamlet is brought,
And speech is as free as the pinions of thought.

But blest as thou art, in our youth we gave ear
To hope when she whispered of prospects more dear,
Where the hills and the vales teem with garlands untold.
And the rainbow ne'er flies with its jewels and gold.

Yet chide not too harshly thy truants grown grey
In the chase of bright phantoms that lured us astray;
For weary and lone has our pilgrimage been
From the haunts of our childhood, the graves of our kin.

Nor deem that with us, out of sight out of mind,
Were the homes and the hearts we left saddened behind;
As the hive to the bee, as her nest to the dove,
These, these have been ever our centre of love.

Yes, when far away from the Land of our birth,
We have mused mid the trophies and Tempes of earth,
Our thoughts, like thy spring-birds flown home o'er the sea,
In day-dreams and night-dreams have still been with thee."

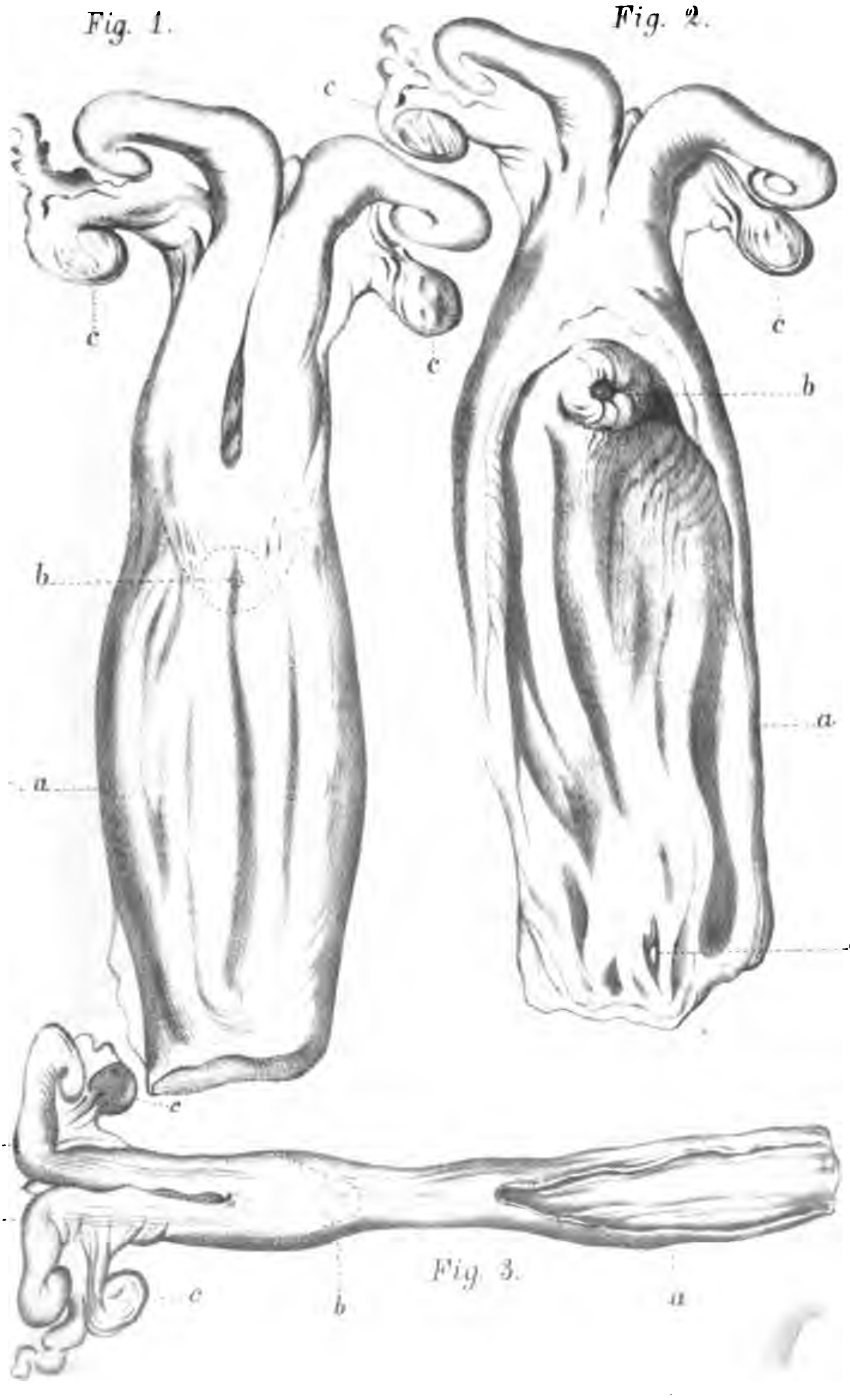
ERRORS.

Page 5, seventeenth line from the bottom for "discussion," read "digression."
Page 8, sixth line from the bottom, for "phosphate of lime," read "phosphates."

TO THE SUBSCRIBERS OF THE JOURNAL.

We have the pleasure of saying that we have already several important articles for the April number. We intend that hereafter the work shall appear promptly at the time it is due. Unavoidable circumstances connected with the printing of the present number has delayed its appearance two weeks beyond the time we had intended.

In conducting this Journal we propose to pursue a method which we think will be of great importance to our patrons. Instead of furnishing them with single articles upon important subjects, we propose giving a series in successive numbers, in order that all which relates to any given subject may be put within their reach; for example, we propose furnishing something upon insects injurious to the vegetable kingdom; instead of limiting the communication to a single essay, we propose following up the subject until it is exhausted, or until the separate communications form a tolerably complete work; so of Agricultural Geology, the food of animals and plants, &c., one number of which we have already given. By pursuing this course we shall place within the reach of every agriculturist all the information he will require upon those subjects, and it is scarcely necessary to add, that if we are sustained in this effort we shall be able to make the Journal superior to most of the periodicals of the kind in this country. Our subscribers will remember that we labor under a disadvantage on account of postage, which the monthly periodicals do not; on this account we are desirous always to forward the work by some cheaper mode than the mail. If we are unable to forward it by the regular express, we hope our subscribers may point out to us some mode of conveyance which shall be satisfactory to them and which will diminish to the least possible amount, the expense of conveyance.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FOOD OF ANIMALS.

BY THOMAS HUN, M. D.

We find in nature two classes of bodies. The one comprehends inorganic substances, which may be simple, or composed of two, or even three or four elements, united in such a way that by ordinary chemical processes they may be analyzed, and again reproduced by the combination of their elements.

There is another class of bodies called organic, which are only found in the vegetable or animal kingdom. They are never simple, but are always composed of at least three, and sometimes of four elements, and the elements are united in such a way, that though the chemist can analyze these substances, he cannot reproduce them by bringing together the elements of which they are formed. Organic matters, or *proximate principles*, as they are called, are formed only in the laboratory of the living plant, under conditions which the chemist cannot imitate.

The elements of which proximate principles are composed, are carbon, oxygen, hydrogen and nitrogen. The three first are present in all, the last in only some of them.

On this is founded a distinction of the highest importance in animal and vegetable physiology, namely, into non-nitrogenized and nitrogenized proximate principles.

Of the non-nitrogenized principles, there are some which are composed of carbon united with oxygen and hydrogen, the two latter elements existing precisely in the proportion for forming water. They may, therefore, be considered as compounds of carbon with the elements of water, and are called neutral principles. The most important of them are starch, gum, and the different kinds of sugar. These substances differ from each other only in the proportion of the elements of water contained in them. They have been considered by some chemists as hydrates of carbon, but this denomination is of questionable propriety, since it is by no means generally admitted that water actually exists in them.

There are other non-nitrogenized principles which are also compounds of carbon with oxygen and hydrogen, but these latter elements are not in the proportion to form water, the hydrogen or the oxygen being in excess. They are called non-neutral compounds. The principal of them are fat, wax, acids, &c.

The nitrogenized principles are albumen, fibrin and casein. They all contain a substance called protein, consisting of carbon, oxygen, hydrogen and nitrogen; and this protein is combined with minute proportions of sulphur and phosphorus. As regards their chemical composition, they differ from each other only in the proportion of sulphur and phosphorus combined with protein. They possess, however, different properties, not depending merely on their chemical composition.

There is a fourth nitrogenized principle called gelatine, found in the bones and cellular tissue, which does not seem to be a compound of protein. Its chemical constitution is still uncertain.

The following table exhibits the proximate principles, and their relation to each other:

Non-nitrogenized principles:	neutral,	starch = 12 carbon + 10 water,
		gum = 12 carbon + 11 water,
		sugar = 12 carbon + 11 water.
	non neutral,	fat,
		wax,
		acids.
Nitrogenized principles:	albumen = protein + S. + P.	
	fibrin = protein + 2 S. + P.	
	casein = protein + S.	
	gelatine—chemical constitution doubtful.	

Besides these organic matters, there are certain inorganic constituents, saline and earthy, deposited in vegetable and animal tissues. They are called the inorganic constituents of vegetables and animals.

These proximate principles are, at the present time, produced exclusively by vegetables. Ordinary chemical processes cannot form them from their elements, and animals can, indeed, in some cases, transform one principle into another, but cannot create any of them from inorganic matters. I say at the *present* time, because geological observations demonstrate that there was a time when no organic matter existed on the earth. At a subsequent period, vegetables, and then animals appeared, produced under conditions and by the operation of causes which we cannot point out, and which certainly do not exist at this day, for there are now no instances of the formation of vegetables or of animals, except from pre-existing beings of a like nature.

In a former article I have undertaken to show how the water, carbonic acid, and ammonia, existing in the soil and in the atmosphere, undergo transformations in the living plant, by which they are converted into starch, gum, sugar, and other proximate principles. The materials out of which these principles are formed, now exist both in the soil and atmosphere, but they may all be ultimately traced to the latter source. The water of the soil originally existed in the atmosphere in the form of vapor, and has been deposited by rain, dew, &c. The carbonic acid and ammonia of the soil are generated by the decomposition of vegetable and animal substances, but these substances themselves were formed from the carbonic acid and ammonia of the atmosphere. Consequently, all the organic matters of plants may be traced to the atmosphere as their ultimate source. The vegetable kingdom is formed from the atmosphere.

The exception to this is found in the inorganic constituents of vegetables, which are derived from the soil by the disintegration and decomposition of the rocks, under the influence of various physical and chemical agencies.

An acquaintance with the composition and mode of nutrition of vegetables, is a necessary introduction to the study of nutrition in animals, because animals derive the matter of which they are formed from vegetables.

Animals cannot produce organic from inorganic substances. All the organic matter entering into their composition is derived primarily from vegetables, then converted into organized tissue, and finally decomposed and restored to the atmosphere in the form in which it entered the plant.

The vegetable kingdom is, then, the grand laboratory in which the food of animals is prepared.

Herbivorous animals live on organic matters as found in vegetables. Carnivorous animals live on the flesh of the former; so that ultimately, both classes draw their nourishment from vegetables.

Just as all the elements of the proximate principles of plants once existed in the atmosphere in the form of water, carbonic acid and ammonia; so all the organic tissues of animals once existed in vegetables. Thus we trace the matter of which animals are formed, to the vegetable kingdom, and this again to the atmosphere; so that ultimately we find that all the matter now making part of vegetables and animals, may be traced to the atmosphere, where it existed in the form of water, carbonic acid and ammonia.

If we would determine what was the composition of the atmosphere before plants and animals existed, we must restore to it all the carbon, oxygen, hydrogen and nitrogen now existing in living animals and vegetables, and in their remains, whether fossil or others. The result of such a calculation would not, however, be altogether true, for the reason that carbonic acid and ammonia are constantly passing into the atmosphere from volcanic and other sources, and it is impossible to estimate the activity of these agencies in past times.

The great problem of nutrition may be thus stated: To trace the water, carbonic acid and ammonia through the various processes in the vegetable kingdom, by which they are converted into organic matters; to trace these organic matters through the processes in the bodies of animals by which they are converted into organized tissues; and finally, to trace this same vegetable and animal matter in its decompositions until it is restored to the atmosphere in the form of water, carbonic acid and ammonia.

These preliminary observations were necessary to prepare for the explanation of the process of nutrition in animals.

All the organized tissues of animals contain the four elements,

carbon, oxygen, hydrogen and nitrogen. With the exception of the gelatinous tissues, about which chemists are not agreed, they are all compounds of protein.

During life these tissues are continually undergoing a change of matter. An act of composition and decomposition goes on within them, so that, while their form remains the same, the matter of which they are composed is continually changing. This composition and decomposition of the tissues constitutes the act of nutrition.

The body of an animal thus changing its materials, while its form remains unchanged, has been compared to the waters of a lake into which streams are emptying and from which other streams are flowing, while its smooth surface reveals nothing of the changes going on within its depths.

Let us see now what is the composition of the streams flowing into the animal (its food,)—what are the changes they undergo in its interior, and what is the composition of the streams as they issue from it—(the excretions.)

Nutrition takes place by a reaction between the blood and the organized tissues. From the blood are derived the materials out of which the organs are formed, and the product of their decomposition enters into the mass of this fluid before it is thrown from the system by the excretions. The loss thus sustained is made up by the products of digestion absorbed from the surface of the stomach and intestines.

From the fact that all the organs are formed from the blood, this fluid has been called *liquid flesh*, and the flesh *liquid blood.*

Composition of the Blood.

The blood, which to the naked eye looks like a homogeneous fluid, is seen under the microscope to be composed of an immense number of circular, flattened disks of about $\frac{1}{3000}$ of an inch in diameter, floating in a transparent colorless liquid. In these disks is contained the coloring matter of the blood, and it is on them that the air acts in the process of respiration. They arrive at the pulmonary capillaries loaded with carbonic acid which they there give off, and then absorb oxygen, which they carry to the different organs.

The transparent fluid in which the disks float is called liquor sanguinis. It consists of two parts—serum and fibrin.

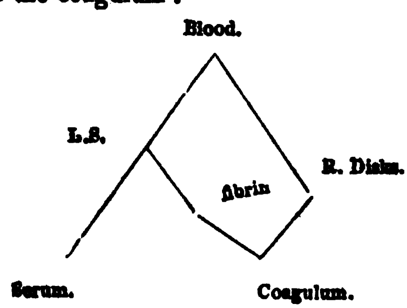
The fibrin is the constituent of the blood on which its property of coagulation depends. So long as the blood circulates in the living vessels, the fibrin remains dissolved in the serum; but when the blood is drawn, the fibrin coagulates and entangles in its meshes the red disks, so that the clot is composed of the fibrin and red disks. Coagulated fibrin, free from red disks, is a straw colored tough, stringy mass.

When, by the act of coagulation, the red disks and the fibrin have been abstracted from the blood, there remains a colorless, transparent fluid, in which the coagulum floats. This is the *serum*. It resembles in appearance the liquor sanguinis, but as it contains no fibrin, it does not coagulate at the temperature of the atmosphere. Serum consists of water, holding in solution the saline ingredients of the blood, and albumen. When serum is heated to 167° F. the albumen it contains coagulates, but not in a fibrous form like fibrin. The white of egg presents a familiar example of albumen. It is a protein compound, nearly identical in composition with fibrin, and like fibrin, it coagulates, but not in exactly the same circumstances. As we shall presently see, albumen has to pass through the form of fibrin before it can be converted into organized tissue.

The following table shows the ingredients of the blood :

Blood, composed of,	red disks.			
	liquor sanguinis.	fibrin.		
		serum,	albumen,	
			salts,	
			water.	

Or the following diagram of Dr. Mandl, ingeniously shows the composition of the coagulum :



There are also in the blood some colorless globules, which I will speak of hereafter.

It now remains to point out the uses of the several ingredients of the blood.

To explain the use of the red disks, it is necessary to premise that the decomposition of the tissues, which constitutes one element of the nutritive act, requires the presence of oxygen. Now the office of these disks is to absorb oxygen from the atmosphere, during their passage through the pulmonary capillaries, and carry it to the other system of capillary vessels, which permeate all parts of the body. Here the oxygen combines with the living tissues, and the result of its combination with their elements is the production of carbonic acid and of the elements of the bile and urine. This carbonic acid thus formed, again combines with the red disks which have just parted with their oxygen, and is carried by them back to the pulmonary capillaries, where it is thrown off with the expired air.

The office of the red disks is thus twofold; 1st, to carry oxygen from the pulmonary capillaries to the general capillary system, where the oxygen combines with the tissues and promotes their decomposition; and 2d, to carry the carbonic acid here generated back to the pulmonary capillaries, where it is rejected from the body.

One word as to the mode in which the remaining products of the decomposition of the tissues are disposed of. The bile contains a large portion of carbon in combination with hydrogen, but as this is re-absorbed after serving its purpose in digestion, it is not properly an excretion. The carbon and hydrogen it contains are ultimately discharged by the lungs in the form of carbonic acid and water.

The elements of urine contain the nitrogenized products of the decomposition of the tissues, chiefly in the form of urea, which readily passes into carbonate of ammonia, by exposure to the air.

We have now explained that portion of the nutritive act, which consists in the decomposition of the tissues. Oxygen is brought by the red disks; this causes their decomposition; the results of this decomposition are: 1st, carbonic acid, which is carried back to the lungs by the red disks, and then thrown off; 2nd, urea and lithic acid, which are compounds of nitrogen and the other elements of the tissues, and which are rejected by the kid-

neys; and 3d, the elements of bile, which contains a large proportion of carbon united with hydrogen, and which after answering a particular purpose in digestion, is re-absorbed with the food, and finally rejected in the form of carbonic acid and water.

To complete this account of the excretions, it is only necessary to add, that the saline ingredients of the blood are also thrown off by the kidneys.

We now pass to the examination of those constituents of the blood which serve for the composition of the tissues.

The fibrin of the blood is the nutritive matter out of which the tissues are formed. This substance, which is in a state of solution while circulating in the vessels, becomes effused through the walls of the capillary vessels, and thus is brought in direct contact with the organized tissues. Here certain changes occur in it; first, it assumes a granular appearance, these granules aggregate together to form nuclei, and around these nuclei membranes form by which they are converted into cells. These cells, constitute the primitive condition of all organized tissues, and by various transformations are converted into the particular tissue in the midst of which they are formed. All the organs are then formed from the fibrin of the blood, and in proportion as a particle is removed by the act of decomposition to which I have alluded, it is replaced from the fibrin circulating through the capillary vessels. Whence is this fibrin of the blood derived? and how is the constant supply kept up?

The *albumen* dissolved in the serum is the ingredient out of which the fibrin is formed; it is the shape which nutritive matter assumes before it becomes fibrin. The similarity of composition between albumen and fibrin has been already pointed out, but there is a further difference of which their chemical constitution gives no explanation. Fibrin coagulates, has a tendency to become organized; it is albumen more highly elaborated and vitalized. The conversion of albumen into fibrin takes place in the blood by means of colorless cells, which differ from the red disks both in their structure and properties. I have already briefly alluded to them.

The saline ingredients of the blood enter into the composition of some parts, as the bones, and also seem to have other uses which are not yet well understood.

I have now given the uses of the different constituents of the blood. The red disks carry oxygen to the interior of the tissues and thus lead to their decomposition, and carry off a portion of the products of their decomposition, the carbonic acid; the nitrogenized products being carried off by the kidneys in the shape of urea and lithic acid. The fibrin is the plastic matter out of which the tissues are formed. In proportion as it is consumed it is replaced by the albumen, which in the colorless cells, is converted into fibrin. The loss of the albumen is itself supplied by the food.

We are now prepared for examining into the nature of the food of animals.

One great object of food is to supply the blood with a portion of albumen, to replace that which disappears by its conversion into fibrin and finally into organized tissue. Since animals are incapable of forming proximate principles from their elements, the food must contain albumen ready formed.

The simplest form of nutrition is that presented by carnivorous animals, and I therefore begin with it as it takes place in them.

Living on the flesh of animals of the same composition as their own, they simply dissolve this flesh in their digestive canal and convert it into an albuminous solution. The earthy matters contained in bones, being insoluble in the gastric juice pass along the intestinal canal and are rejected as fœces, which in these animals consist almost exclusively of the earthy portion of bones with hairs and other insoluble matters.

The albuminous solution resulting from the digestion of the flesh is absorbed by the lacteal vessels, and enters the mass of the blood, to replace the albumen which has been converted into fibrin, and finally expended in the nutritive process.

A portion of the tissues is then decomposed and ultimately rejected from the system, in form of carbonic acid and urine; a corresponding amount of matter is withdrawn from the blood to form new organized tissue, and a corresponding amount of nutritive matter is introduced into the blood to compensate for this loss.

We ought then, to find in the excretions of the animal, the same amount of matter and the same elements differently combined, as in the food; not that the food is directly converted into these excretions, for it has first to pass through the state of organized

tissue, but this organized tissue is itself exactly replaced by the food, so that the result is the same as though the food itself were at once converted into the excretions.

In the above exposition, I have taken the simplest form of animal nutrition, that of carnivorous animals, and in order to prevent complication, I have represented this as more simple than it is in reality, for I have omitted one essential ingredient of their food, the fat.

What becomes of the fat contained in the food of these animals? What is its use? It is not found as fat in the excretions; it does not make part of the body of the animal, for in general, carnivorous animals are remarkably destitute of fat.

Nor can it contribute to the formation of the organized tissues, for they all contain nitrogen, and fat is a compound of carbon, oxygen and hydrogen. We cannot suppose that it abstracts nitrogen from the albuminous principles of the food, for these principles contain nitrogen precisely in the necessary proportions for the formation of the tissues.

The fat is absorbed with the albuminous products of digestion, passes into the chyle and ultimately into the blood. A portion is in some cases deposited in the cellular tissue as fat, the rest disappears. What becomes of it? What form does it assume?

The oxygen, introduced by the red disks, is not all consumed by the decomposition of the tissues. A portion of it remains, which combines in the blood with the carbon and hydrogen of the fat and forms carbonic acid and water. The fat is thus burned in the blood by the oxygen, and is thrown off in the shape of the two compounds just named. It thus contributes to generate animal heat, for by this slow combination as much heat is generated as by their rapid combustion, attended with flame and light, when it takes place in the air or in oxygen. Heat is also generated by the union of oxygen with the carbon liberated in the decomposition of the tissues, but this decomposition is not in general sufficiently rapid to liberate carbon enough to generate all the heat required.

Fat, then, is not a supporter of nutrition. It does not contribute to the formation of organized tissues. It is a supporter of respiration; a means of generating heat.

The principles of the food are therefore divisible into two classes :

1. Supporters of nutrition, which are the albuminous matters or protein compounds.

2. Supporters of respiration—fat.

To resume. The food of carnivorous animals is composed of,

1. Water; which acts only as a solvent and not as an element of nutrition, and is rejected as water by the lungs and kidneys.

2. Saline and earthy matters: they contribute to the formation of the bones, and enter into other tissues and perform other uses not understood. They correspond to the *inorganic constituents* of plants. They are rejected by the urine and fœces, and render these matters so valuable as manures.

3. Albuminous matters: Protein compounds, supporters of nutrition. These are dissolved, converted into fibrin, and constitute the nutritive principle of the food. After becoming organized they combine with oxygen, and are rejected as urea and carbonic acid. The urea, by exposure to air, is speedily converted into carbonate of ammonia.*

4. Fat: supporter of respiration; generator of animal heat; combines with oxygen and is rejected as carbonic acid and water.

5. Oxygen: which is not usually called an article of food, but is introduced by the lungs rather as a means of waste than of repair, and is rejected in the combinations already mentioned.

I pass now to the nutrition and food of herbivorous animals.

The mode of nutrition in herbivorous animals differs less from that of carnivorous animals than was formerly supposed.

Recent chemical discoveries have established the fact that protein compounds, albumen, fibrin and casein, which are the supporters of nutrition in carnivorous animals, also exist in vegetables ready formed. Consequently herbivorous animals replace the albumen of their blood by the albuminous matters derived from vegetables, and so far their nutritive process does not differ from that of carnivorous animals.

The different forms of fat, oils, &c., are found in vegetable as well as in animal food, and herein herbivorous animals are nour-

* Gelatine is a nitrogenized principle but not a compound of protein, which is found in the bones and cellular tissues of animals. The mode in which it is disposed of, and its nutritive properties are involved in so much doubt, that I have thought it best to avoid the question in this paper.

ished like the carnivorous. The only difference is, that in the former a larger share of fat is stored up than in the latter.

In vegetable food, besides the albuminous and oleaginous principles, there is a third principle which is not found in animal food; this is the saccharine principle, comprehending starch, gum, sugar, and the whole of the non-nitrogenized neutral compounds of which I spoke in the beginning of this paper.

This principle, containing no nitrogen, cannot contribute to the formation of the organized tissues. Its uses are analogous to those of fat. Its carbon combines with the surplus oxygen, and is converted into carbonic acid, thus generating animal heat. For this reason the saccharine principle is, by Liebig, classed with fat, among the supporters of respiration.

The oleaginous and saccharine principles of the food are not, however, in all cases at once consumed by oxygen, introduced by respiration. When the animal takes but little exercise, and the respiration is consequently inactive, these principles find no surplus oxygen to combine with, and then the oleaginous principle is stored up as in the cellular tissue as fat, and the saccharine principle by a change in its elements, gives off a portion of its oxygen, and is converted into fat, which, as will be remembered, is a combination of the same elements in different proportions. This is the only instance in which one proximate principle is converted into another in the animal body. This conversion, first maintained by Liebig, was denied by Dumas, who undertook to show that in the food of herbivorous animals there was sufficient oil to account for all the fat of the animals, but I believe the point has subsequently been abandoned by Dumas himself. It seems indeed very improbable, that the grass eaten by a milch cow contains as much oil as is found in her milk.

It follows from this that in proportion as an animal takes more or less exercise, will the oleaginous and saccharine principles be consumed in the body or stored up as fat for future use.

Let us now turn to the difference between the food of carnivorous and herbivorous animals. Both contain the albuminous and oleaginous principles, and the latter contains, in addition to these, the saccharine principle. The food of carnivorous animals is made up of a large proportion of the albuminous principle, united with a small portion of fat; that is, of a large portion of the supporter

of nutrition with a small portion of the supporter of respiration. The food of herbivorous animals is made up of a small portion of the albuminous principle or supporter of nutrition, and of a much larger portion of the oleaginous and saccharine principles which are supporters of respiration. There is a corresponding difference in the nutrition of the two classes. In carnivorous animals the change of the tissues take place with rapidity, and a large supply of albumen is required to take the place of that which disappears in the formation of the tissues. There is sufficient carbon thus liberated to saturate the oxygen introduced by respiration, and to maintain the animal temperature; the small portion of fat in the food saturates any surplus of oxygen. In herbivorous animals the change in the tissues is slower; less albumen is therefore required, and more of the non-nitrogenized principles or supporters of respiration are required to saturate the oxygen introduced by the lungs.

The supporters of nutrition in food are, the protein compounds albumen, fibrin and casein, as found in vegetables and animals. They are destined to repair the waste of the tissues, and by their decomposition give rise to carbonic acid, water and urea, which, by the addition of water, becomes carbonate of ammonia.

The supporters of respiration are the different kinds of animal and vegetable fat and oil, constituting the oleaginous principle and the neutral non-nitrogenized compounds, sugar, gum, starch, constituting the saccharine principle. These principles are either stored up as fat, or consumed by oxygen, and in both cases are ultimately thrown off in the form of carbonic acid and water.

The organic matters of the food are then ultimately thrown off in the form of water, carbonic acid and carbonate of ammonia. The saline matters pass off in the urine and fœces in the form in which they are introduced.

Thus the animal restores to the atmosphere by the lungs, and to the soil by the urine and fœces the compounds which serve as food for plants.

Vegetables convert inorganic compounds into proximate principles; animals convert these proximate principles into inorganic compounds.

There is but one substance produced in nature which contains all the elements of the food of animals so mixed as to be capable of serving permanently as an an article of food. That is milk.

An examination of the composition of milk will serve to confirm and to illustrate the preceding remarks.

When milk is allowed to stand it is found to separate into two parts, the cream which floats on the surface, and a clear fluid underneath. This cream consists of globules which may be easily seen by means of the microscope, and are composed of oil. They are mechanically suspended in the milk, and rise to the surface on account of their lesser specific gravity. When heated, or when beaten for a certain time, their envelope is broken and they form butter.

Milk is thus found to be composed of fat, existing in the state of globules and floating in a thin fluid. This recalls to a certain extent the composition of the blood.

If we add to the skimmed milk an acid, it separates into two parts, a coagulum and whey. Here again is an analogy with the liquor sanguinis.

The coagulum is composed of an albuminous matter called casein, the composition of which has already been explained. It is a compound of protein with sulphur.

The whey is composed of water, holding in solution a kind of sugar, called sugar of milk, and also phosphates and other saline ingredients.

In milk, we thus find, besides the saline ingredients and water, an oleaginous principle, an albuminous principle and a saccharine principle, that is, the three great staminal principles of the food. The albuminous principle serving as a supporter of nutrition, and the oleaginous and saccharine principles serving as supporters of respiration.

In butter we have the oleaginous principle separated from the others. In cheese we have the casein united with the butter, as in fat cheese, or separated in a great measure from it, as in skimmed milk cheese. In whey we have the sugar alone with the saline ingredients.

It was remarked by Prout, before the views of Liebig concerning the nature of the food were published, that milk contained the three great staminal principles of food, and that whatever might be the nature of the food it was necessary that at least two of these principles should be present in order to support life for any length of

time. Thus, although the albuminous principle is all that is required to replace the fibrin of the blood consumed in the act of nutrition, yet animals fed on white of egg alone, perish after a certain time of starvation. For a still stronger reason, animals fed on pure sugar, or gum, or starch, or oil alone, die of starvation, for these substances contain no materials for repairing the waste of the tissues. In the simplest kind of food, as that of carnivorous animals, there is a mixture of the albuminous principle with fat. In the food of herbivorous animals there is a mixture of the albuminous with the saccharine, and with a smaller portion of the oleaginous principle.

"But," says Prout, "it is in the artificial food of man that we see this great principle of mixture most strongly exemplified. He, dissatisfied with the productions spontaneously furnished by nature, culls from every source, and by the power of his reason, or rather of his instinct, frames in every possible manner, and under every disguise, the same great alimentary compound. This, after all his cooking and art, however he may be inclined to disbelieve it, is the whole object of his labor, and the more nearly his results approach this, the more nearly they approach perfection. Thus, from the earliest times, instinct has taught him to add oil or butter to farinaceous substances, such as bread, which are naturally defective in this principle. The same instinct has taught him to fatten animals with the view of procuring the oleaginous in conjunction with the albuminous principle, which compound he finally consumes, for the most part, in conjunction with saccharine principles, in the form of bread and vegetables. Even in the utmost refinements of his luxury, and in his choicest delicacies, the same great principle is attended to; and his sugar and flour, his eggs and butter, in all their various forms and combinations, are nothing more nor less than disguised imitations of the great alimentary prototype—*milk*—as presented to him by nature."

From what precedes, it will be seen that there are three great staminal principles of food:

1st. The albuminous, which is destined to repair the loss of the tissues in the act of nutrition; that is, destined to be converted into organized tissues.

2. The oleaginous principle, containing a large proportion (60 per cent) of carbon united with hydrogen and oxygen, but not in

the proportions to form water, the hydrogen being in excess. This principle is destined to combine with the oxygen introduced by respiration into the blood, and by the combustion of its carbon and hydrogen to generate heat. When there is not enough of oxygen introduced to burn up all the fat of the food, this principle accumulates in the cellular tissue.

3. The saccharine principle, including sugar, gum, starch, and all those substances composed of carbon, combined with oxygen and hydrogen in the proportion to form water. The use of this principle is nearly the same as that of the oleaginous; it serves for generating animal heat, but in a less degree, for it contains less carbon, and the other two elements are in such proportions as to have satisfied their affinities, and no surplus hydrogen remains to be burned. The saccharine principle undergoes conversion into fat, when there is a deficiency of oxygen for its combustion.

Let us now apply these principles to determining the proportions in which these principles should be combined, in the food of man and of animals under different circumstances.

In proportion as the waste of the tissues is greater in nutrition, will a larger supply of the albuminous principle be required in the food to replace the fibrin abstracted from the blood. Muscular exercise contributes to an increased activity of the nutritive act, and thus renders a larger proportion of this principle necessary.

In proportion as the surrounding atmosphere is colder will the body be required to generate more heat in order to preserve its uniform temperature. This increased heat is generated by exercise and by proper diet. Exercise generates more heat in two ways: 1st, by accelerating the circulation and respiration, it introduces more oxygen into the blood; 2d, by increasing the activity of the decomposition of the tissues in nutrition, it liberates more carbon which is burned by the oxygen. The diet of one taking active exercise in a cold air, should contain a large portion of the albuminous principle, to replace the waste of the tissues and of the oleaginous principle to be burned by the surplus oxygen. A man or animal laboring in a cold air requires food rich in these two principles and soon sinks under a diet composed of a large portion of the saccharine principle—such as rice, fruits, &c. A starving man freezes if exposed to cold, and the same thing happens to a man well fed but kept at rest. The former freezes because, though

he has oxygen enough in the blood it finds no fuel to burn; the latter because, with plenty of fuel there is not enough oxygen introduced to consume it.

Alcohol is also ranked by Liebig among the supporters of respiration. Its composition very nearly resembles that of fat, being a compound of carbon with oxygen and nitrogen, the latter being in excess. Its action is two-fold; it is a supporter of respiration and a special excitant of the nervous system. In the latter mode of action it is altogether different from any oleaginous compound. As a supporter of respiration its action is exceedingly prompt, from the rapidity with which it is absorbed and from the avidity with which it is burned by the oxygen. In this way it warms the body suddenly, but by exhausting the oxygen of the blood it leaves the system more exposed to the cold than before, unless by active exercise the introduction of oxygen is kept up in a degree proportionate to its consumption. The blood of drunkards is remarkably black, in consequence of being loaded with carbonic acid.

If we examine the diet adopted by inhabitants of cold and hot climates, we find it to correspond with the principles just laid down. In arctic regions where active exercise is necessary in order to resist the cold and to provide food, the diet consists mainly of animal flesh, with a large quantity of fat. Europeans read with astonishment the immense quantities of meat and fish oil consumed by the Esquimaux, and which are rendered necessary by their severe climate. Exposed to an atmosphere below zero, imperfectly protected by their miserable huts, they are compelled to burn the fuel by which their temperature is maintained, within their own bodies. Hence too, the avidity with which they seek after, and the impunity with which they bear large quantities of ardent spirits.

In tropical climates, nature provides abundantly for the wants of men, with little labor on their part. With this diminished necessity for muscular exertion, the temperature of the atmosphere is such as to require little animal heat to be generated, and consequently but little activity of the respiratory functions. Diminished muscular effort is attended with diminished waste in nutrition, and hence a small amount of albuminous matter in the food suffices. At the same time the moderate activity of the respiratory function renders the more active supporters of respiration,

such as fat and ardent spirits, inappropriate. The diet of the inhabitants of these countries consist therefore mainly of the saccharine principle, united with small proportions of the other two. The rice and fresh fruits which constitute the repast of the Hindoo, offer as striking a contrast with the flesh and train oil of the Esquimaux, as the warm skies and lazy life of the former do to the snow huts and hunting excursions of the latter.

If we would produce a great muscular development with little fat, much exercise is necessary and a diet composed of albuminous matter, with little of the oleaginous or saccharine principle. This is the diet on which carnivorous animals subsist, and the hardness of their muscles and absence of fat are well known. This is also the diet on which men are put when *trained* in England for prize fighting. Jackson, a celebrated *trainer*, stated to John Bell that he usually began the system by an emetic and two or three purges. Beef and mutton, the lean of fat meat being preferred, constituted the principal food; veal, lamb and pork he found less digestible. Fish was said to be a "watery kind of diet," and is employed by jockeys who wish to reduce their weight by sweating. Stale bread was the only vegetable food allowed. The quantity of fluid permitted was 3½ pints, but fermented liquors were strictly forbidden. Two full meals with a light supper were usually taken. The quantity of exercise employed was very considerable, and such as few men of ordinary strength could endure. The effects of trainers' regimen are hardness and firmness of the muscles, clearness of skin, capability of bearing continued severe exercise, and a feeling of freedom and lightness (or "corkiness") in the limbs.

If instead of great muscular development we would favor the production of fat with tender muscular flesh, we must adopt a different regimen. First of all, we must secure rest, for exercise develops the muscles, and by giving activity to respiration it introduces more oxygen, which burns up the fat. With this we must have a somewhat elevated temperature without which rest is impossible. The diet should consist of a small proportion of the albuminous principle with a free use of the oleaginous and still more of the saccharine principle. With such a regimen the fat of the food finds no oxygen to burn it, and is stored up in the cellular tissue, while the saccharine principle, for the same reason,

is converted into fat and is likewise stored up. Thus it is, that Turkish women, shut up in the harem, without exercise of mind or body, living on a farinaceous diet, acquire the embonpoinment so highly prized as an element of beauty in their country; and indeed, it is to this cause that women in general owe the softness of muscle, their roundness of outline, which contrasts so strikingly with the muscular development and angular contour of men.

The application of these principles to the feeding of animals according to the object we have in view, is sufficiently obvious. If we would simply fatten an animal and prepare it for being eaten, we keep it at rest in a warm stable, and give it food containing an abundance of the supporters of respiration, so that its muscles may become tender and that the oleaginous and saccharine principles of the food may not be consumed in warming the animal but may be deposited as fat. If on the other hand we wish to procure hard and strong muscles, as in a race-horse, we keep him in exercise and give him food containing more largely of the albuminous principle. Contrary to a common opinion, food rich in albuminous matter does not contribute to the production of fat. It is not very unusual for persons who wish to repress a disposition to obesity, to avoid animal food and restrict themselves to vegetables, and find to their surprise that the accumulation of fat takes place more rapidly than before.

The use of alcoholic drinks dispose to obesity, unless they are abused to such a degree as to give rise to a derangement of digestion, which prevents the introduction of nutritive matter into the blood. Although the composition of alcohol is analogous to that of fat, it is not probable that it undergoes conversion into fat in the body, but rather that, by combining rapidly with the oxygen of the blood, it leaves a larger portion of the saccharine and oleaginous matters of the food to be converted into and deposited as fat. Fermented liquors contain a quantity of saccharine matter, and are for this reason particularly apt to cause obesity. Indeed, any cause which consumes the oxygen of the blood, or prevents its introduction, has a tendency to produce an accumulation of fat. Want of exercise operates in keeping the respiration sluggish, and thus preventing the introduction of oxygen. Asthma, and diseases of the heart, by obstructing the circulation through the lungs, have a similar tendency.

When a person who has taken exercise freely in the open air, and has lived on a diet of animal food with alcoholic drinks, changes his habits of life and becomes sedentary, and continues the same diet, he falls into disease. The large proportion of albuminous matter of the food no longer finds its use in repairing the waste of the tissues in nutrition, and hence accumulates in the blood. This fluid becomes too rich in nitrogenized principles; there is an inflammatory state of the system produced; the formation of urea and still more of uric acid, becomes excessive, and hence arises a disposition to gravel, gout, or rheumatism, three diseases closely allied to each other. They all seem to be connected with an excess of nitrogenized principles in the blood, though this does not always arise from the same cause.

The lungs and liver have functions analogous in this respect, that they both separate carbon from the blood; in the former it is combined with oxygen; in the latter with hydrogen. There is a certain degree of antagonism between these glands, the inertness of the one being compensated by an increased activity of the other. In cold climates the lungs are most active, and are hence disposed to inflammatory affections. In hot climates, when the lungs separate the carbon imperfectly from the blood, the liver is thrown into increased activity, and hence its diseases are here most common. Europeans who pass to tropical climates, and continue their diet rich in fat, with free use of alcoholic drinks, inevitably bring on disease of the liver by overtasking this organ. The same thing happens to those who in temperate climates indulge in such a diet, while they lead a sedentary life in warm houses. Drunkards, almost always induce disease of the liver by surcharging the blood with carbon and hydrogen, and thus keeping the liver in a state of constant excitation. This explains also how persons leading an active life can resist the effects of alcoholic drinks, even when taken in excess, so much better than those who are sedentary. The former work off a part of the alcohol by their active respiration; in the latter the whole labor falls on the liver.

CLIMATE OF THE STATE OF NEW-YORK.

One of the most important problems to be solved in determining the agricultural capabilities of any country, is its climate. Common observation and experience is perhaps sufficiently exact to establish the truth of the proposition in a general way. A hasty examination, for example, of the natural productions of a valley and of the adjacent mountain, of a marshy or an arid district, of the shores of a sea, lake, or large river, of a warm and a cold region, and of an inland position, will show that they differ materially in their products; a difference which, without doubt, will be attributed to what is termed climate. The word is here used in its widest sense, and may be defined the character of a place, as determined by observations on latitude, height above the sea, vicinity to water, prevalent winds, position and slope of lands, nature of the rocks and soil, and degree of cultivation. If climate, then, is determined by these conditions, it will be well to occupy a few moments on each of them, taken singly. 1st. Climate does not depend wholly upon latitude, for observation proves that two places upon the same parallel neither agree in temperature, nor in any two of the other conditions which determine its character. If they agree in the mean temperature for the year, they may not agree in the temperature of their seasons. One, for instance, may enjoy cool summers, the other may be hot and comparatively dry. So, one may have a mild winter, while at the other it is severe and rigid. Under these characters Paris and Quebec have often been contrasted. Again, two places in the same latitude, but of different heights above the level of the sea, will differ in climate. If, for example, one is five or six hundred feet higher than the other, it will be from one to two degrees colder than the other.

The other conditions which modify climate are not of equal consequence with the two preceding ones. Vicinity, however, to large bodies of water, may be, perhaps, of equal consequence. The winds also exert a perceptible influence. In this country the northwest winds are cold, and where from the shape and contour of the surface they prevail, the temperature will from this

cause alone, be slightly reduced. Then, again, a southern exposure is more favorable to vegetation than a northwest exposure. The color and composition of soils, too, cannot be overlooked in the list of causes which modify climate. These, however, are more local and less general, unless, indeed, the area is greatly extended.

Places which are known to enjoy an equal temperature are called *isothermal*, signifying merely an equal temperature. Imaginary lines connecting such places, are called *isothermal* lines. We have already said, in effect, that these cannot coincide with the lines of latitude drawn upon a map, or a terrestrial globe; they therefore intersect them at various angles, and form by themselves a peculiar system of lines approaching only to parallelism among themselves—for example, those which are drawn upon a map of Europe, do not coincide or run parallel to those of America; as the line of equal temperature in the two continents runs twelve degrees farther north in the former than in the latter.

Another result which has been obtained by careful observation is, that two places may receive an equal amount of heat, during a part of the year only; that is, it will enjoy an equal summer or an equal winter temperature. Lines or curves, representing these facts, are termed *isotheral* and *isocheimal* lines; the former referring to equal summer, the latter to equal winter temperature.

The temperature of the atmosphere is influenced by, and depends upon, the heating power of the earth, the rays of the sun passing through it without imparting their caloric directly to its particles. On being received, however, upon the surface of the earth, it becomes heated, and then imparts a portion of its temperature to the stratum of air in immediate contact with it. This, in consequence of its expansion, has its specific gravity diminished, and hence rises and gives place to another stratum, which in its turn also ascends. By these changes of place then, the body of the atmosphere is heated and its temperature elevated. But this process only expends a part of the heat received from the sun. The remaining heat is conducted downwards from particle to particle, diminishing of course according to the distance from the surface, till finally we reach a depth which is unaffected by the sun's rays. The superficial temperature of the soil of any given place will vary as well as that of the air; the color of the soil, its na-

ture as it regards composition, height, slope, etc., all have their influences in a greater or less degree.

There are a few other general considerations in regard to climate, which it may be well to state in this place. We notice first, the globular figure of the earth. A body of this form receives the greatest number of rays from the sun on a given space, when they fall vertically upon it. In the second place, the space over which the sun approaches to verticality is increased by the obliquity of the earth's motion in regard to the plane of the equator. By this arrangement the sun apparently travels over a broad zone, equal to 47° in breadth. Then again, the diurnal revolutions of the earth produce the agreeable changes of day and night and an innumerable number of other important modifications of temperature.

It is perhaps impossible to conceive of all the results which must have followed had these several arrangements been differently disposed. If, for instance, the axis of the earth had been placed perpendicular to the plane of its orbit; in this case, the sun would have been always vertical to the same places and those places would have been, as a consequence, burnt, or parched with heat, but in consequence of the obliquity of the axis, the extent of the temperate zones has been produced far towards the poles, and has thereby rendered most of the earth's surface a fit abode for animals and plants.

The atmosphere also, from its great mobility, is an agent for distributing heat; it not only rises upwards, but is impelled forwards; moving over the surface of the earth with rapidity in some instances, and at the same time bearing along and distributing the caloric imparted to it from the earth.

The temperature too, of the current itself, is modified by the surface over which it passes. Traversing a low, sandy plain, it becomes hot and dry; over the sea, damp and chilly; and over high mountains, cold and pinching.

Such are some of the causes which operate generally in modifying climate.

Leaving these general views of climate, we pass to the consideration of the climate of New-York. In pursuing this subject, it is perhaps unnecessary to say, that it is also modified more or less by all the circumstances which have been enumerated. But in order that we may have a full understanding of the climate of the state,

it is necessary that we should possess some knowledge of the face of the country under consideration, as the climactic features are inseparably connected with physical characters. Mountains, or high lands condense upon their sides the vapor of the atmosphere, which, if approaching the line of perpetual snow, will freeze, and become a source of cold by absorbing the caloric of the warmer regions, whether near or remote. They increase too, the supply of water in their vicinity, and tend greatly to preserve an equality in the streams which issue from them during the whole year. They modify the direction of winds, and shelter the products of their sides in some cases, while in others the exposures are increased by receiving the direct currents which move over them without mitigation. Dwarf and shrubby productions are always found on the exposed mountain sides—an effect which is not due to elevation alone.

The most important mountain chain of high lands in New-York is north of the Mohawk valley. These high lands may be considered as rising near Little-Falls, where, taking a north east course, they terminate partly upon Lake Champlain, and partly in the Canadian plains.

This belt of country is 70 miles wide, and is in fact table land, which, upon an average, is 1,000 feet above the level of the sea, or the tide water at Albany; but a portion of it is from 1,500 to 1,800 feet above the same level. From this table-land a great number of peaks or ridges rise, which attain a height of from 1,200 to 3,400 feet. These are steep and precipitous, and worthless as lands for tillage. But they will supply eventually an immense quantity of lumber and wood. The valleys are high and narrow, with scarcely an interval of half a mile. From this high and broken country most of the rivers and creeks which supply the state with water, take their origin—as the Hudson, Mohawk, Black River, De Grasse, Racket, Salmon, Saranac and Ausable.

From these facts it appears that in the limits of New-York, and south of the latitude of 45 degrees, the land is sufficiently high to modify the climate very perceptibly. The highest points furnish an Alpine vegetation, and probably every night during the summer, water is congealed upon the exposed parts of their tops. The diminished temperature of this part of the state is seen in the husbandry; corn or maize is a precarious crop, and even wheat has

been cut off by frost in August, at the base of the highest of the Adirondacks.

East of the Hudson there is another belt of high land, ranging nearly north and south, which is laid out in narrow ridges, which geologically consist of slate and limestone. These are prolonged into Canada. They probably present a medium height of 1,000 to 1,200 feet, but rising occasionally to 3,500 feet. The vegetation upon the top of these ridges, when they rise above 1,000 ft., shows merely the effects of the northwest wind, in the diminished height of the trees and their more shrubby growth; but they produce no where an Alpine vegetation. South of the Mohawk valley a hilly country prevails in all that region which is commonly called the Helderberg. South of this hilly range, and west of the Hudson, the Catskills form another important mountain chain, though less elevated by 1,800 feet than the Adirondacks. As a whole, then, New-York presents a surface greatly diversified—in some portions rising into very respectable mountains, in others it is depressed and traversed by long parallel valleys; only a small portion of the surface is of that character which can be denominated level.

With these remarks, we proceed to speak of the temperature of New-York, and in this connection it is proper to remark that the results which are given in the following pages were obtained principally from the Regents' Reports, and from a paper prepared by Mr. James H. Coffin for the agricultural survey of the state, now in progress. These reports are made up from the returns of fifty-eight different localities, at which meteorological observations have been kept. These localities are scattered over a great variety of surface, and hence they indicate pretty fairly the climate of the state, or rather the meteorology of the state. The mean temperature of the fifty-eight places at which observations have been made for seventeen years, is forty-six degrees forty-nine minutes, but, as already remarked, the relative temperature of different sections of the state, while it depends chiefly on latitude and elevation, is modified by the circumstances already stated.

From numerous observations made within the limits of the state, it is very satisfactorily determined that the rate of decrease in temperature amounts to 1° for 350 feet of elevation; from some observations the rate is greater, and in some less; but as this is near

the mean for all the observations which have been made, it appears sufficiently exact for all our purposes.

In order to obtain a correct expression of the leading characters of the climate of New-York, it is essential that its territory should be divided into districts, inasmuch as an expression for the whole state, taking the mean temperature, for instance, as that expression, will only approximate to the object sought. We propose, therefore, to divide the state into the six following districts: 1. Long-Island; 2. Valley of the Hudson; 3. Valley of the Mohawk; 4. District north of the Mohawk, extending from the east line of the state to Lake Ontario; 5. District southwest of the valley of the Mohawk, extending from the valley of the Hudson to the vicinity of the smaller lakes; 6. District west of the smaller lakes.

The climate of the state may be examined in reference to its mean temperature—the extremes of heat and cold—the length and forwardness of the seasons, and the progress of vegetation. By obtaining the results of each of the districts, and comparing them with one another, and with that of the state at large, we shall obtain all the important facts in regard to its climate. The length and the forwardness of the seasons, and the progress of vegetation, is determined by the appearance of robins, and other birds of passage: the blooming of trees and plants; the ripening of strawberries; the commencement of the hay and wheat harvest, and the first killing frost. The mean time of these for the whole state for fifteen years, ending with 1842, and also the mean temperature, and mean of the annual extremes, is shown in the following table, which may serve as a standard of reference in examining the same kind of facts in the different sections of the state:

	Mean Date.	No. of localities	Number of observations.
Robins first seen,	March 19	44	268
Shadbush in bloom,	May 1	48	168
*Peach in bloom,	" 2	57	175
Currants in bloom,	" 4	58	269
Plum in bloom,	" 6	52	264
Cherry in bloom,	" 7	52	250
Apple in bloom,	" 15	59	374
Lilac in bloom,	" 15	45	151
Strawberries ripe,	June 12	58	210
Hay harvest commenced,	July 8	34	127
Wheat harvest do.	" 25	45	186
First killing frost,	Sept. 23	57	471
First fall of snow,	Nov. 5		536
Mean temperature,	46° 49'	59	577
Mean annual maximum,	92° 00	59	550
Mean annual minimum,	12° 00	59	551
Mean annual range,	104° 00	59	550

1st District—Long-Island. Observations have been made at Oyster Bay, Easthampton, Jamaica and Flatbush. The feature which distinguishes the climate of this section is the uniformity of its temperature, occasioned by the equalizing influence of the ocean. The places at which observations have been made, are all at a low level, in the extreme south part of the state. The greatest heat of summer is 1½° less on an average, than in other parts of the state which are further north, and more elevated. On the contrary the extreme cold of winter is less by 10° to 18°, and has been so uniformly, every year for the past fifteen years. It is worthy of notice, that the temperature of Easthampton and Jamaica, is considerably less than is due to latitude and elevation. The former place, it is 2°.55, which is a greater difference than at any other place in the state. This fact is also indicated by the backwardness of the seasons. The trees bloom there later by a week than they do in the interior of the state, and two weeks later than at the west end of the island. The spring is but a little earlier than on the Black river, in Lewis and Jefferson counties. But notwithstanding the lateness of vegetation in the spring, agriculture does not appear to be so much retarded. Strawberries ripen, and the wheat harvest commences there earlier than the average of the state, though considerably later than at the west end of the

* The peach is considered the mean for the middle and south part of the state only.

island. Farther, the time lost by the lateness of the spring, appears to be made up in the fall. With scarcely an exception for the last fifteen years, the first killing frost in autumn has occurred much later at Easthampton, than at any other place in the state which has been reported. The average time has been a full month later than the average of the state, and nearly three weeks later than at Jamaica or Flatbush.

2d District—The valley of the Hudson. In this district, observations have been made at Mount-Pleasant, North-Salem, Goshen, Montgomery, Newburgh, Poughkeepsie, Kingston, Redhook, Hudson, Kinderhook, Albany, Lansingburgh, Cambridge, Salem and Granville. The mean temperature of Albany is found to be 1°.98 higher than the mean temperature of the state, as determined by observations for fifteen years. The extreme summer heat of this valley is greater by several degrees than in any other section of the state, and particularly has the thermometer risen higher at Montgomery, Poughkeepsie and Lansingburgh; and the latter place is equally remarkable for the extremes of cold in the winter. Kinderhook is also remarkable for its extreme cold in winter. North-Salem is subject to early frosts, having occurred there ten days sooner than the average of the state, and more than fourteen earlier than in the valley of the Hudson generally. As we ascend the Hudson, the opening of spring becomes gradually later, the difference between New-York and Albany being about a week. The climate at Cambridge, Salem and Granville, becomes more rigid both from elevation and latitude. The extreme cold of winter is more intense by 10°, than at any other place on the Hudson south of Lansingburgh, and the spring opens several days later.

3d District—Valley of the Mohawk. Locations at which observations have been made, are Schenectady, Johnstown, Canajoharie, Fairfield, Utica, Whitesborough. At Utica the temperature due to latitude and elevation is 46°.20, and the mean temperature is one degree less than the mean of the state, and at Fairfield it is 2°.98 less.

The average mean temperature of this valley is lower by one degree than the average of the state. The winds of this valley have been shown by Mr. Coffin to be more northerly at Utica and Whitesborough than in other parts of the Mohawk valley. At

Schenectady and Canajoharie, vegetation advances more rapidly than the average of the state, and at Johnstown and Fairfield less so. The difference between Canajoharie and Fairfield, though only about 20 miles distant, is about a fortnight, which is owing to the elevation of the latter place. Utica may be considered a fair representative of the climate of the state. The vegetation at Utica agrees within a day with the average forwardness and its progress through the state.

4th District—North and northwest of the Valley of the Mohawk. Places where observations have been made, are Mexico, Belville, Lowville, Gouverneur, Ogdensburgh, Potsdam, Malone and Plattsburgh.

The mean temperature at Ogdensburgh is 44°.27. Gouverneur, the same; Plattsburgh 44°.65. These are temperatures due to latitude and elevation. In this whole district we have the characteristics of a more rigid climate; low mean temperature, extreme cold in winter, great range of the thermometer, backward seasons and early frosts. Gouverneur is colder by over one degree, and appears to be the coldest place but one in the state from which records are received. It stands unrivalled as it regards extreme cold in the winter. Ogdensburgh is less liable to extremes of heat and cold than the average of the state, from its vicinity to a large body of water.

5th District—Embracing a region south and southwest of the Valley of the Mohawk. Observations have been made at the following places: Pompey, Homer, Cazenovia, Hamilton, Bridgewater, Oxford, Hartwick, Cherry-Valley, Delhi. Mean temperature at Pompey, for 14 years, was 44°.9; Cherry-Valley, 44°.20; Delhi, 44°.92. These temperatures are due to elevation and latitude. Pompey is the coldest place reported in the state, being 3°.52 lower than the average of the state. It is situated on high ground, and yet the thermometer does not sink so low in winter, nor do the autumnal frosts occur so early as in the state generally. At all other places in this district the thermometer sinks lower than the average of the state by 4° to 11°, and the autumnal frosts occur earlier by four to thirteen days. Robins appear earlier in this part of the state, the vegetation is uniformly backward, though less so than at places in the northern parts of the state which have the same mean temperature.

6th District, or the Western part of the State, embracing Onondaga, Auburn, Aurora, Ithaca, Prattsburgh, Canandaigua, Palmyra, Rochester, Henrietta, Middlebury, Gaines, Millville, Lewiston, Buffalo, Springville, Fredonia, Mayville.*

Mean temperature of Buffalo, 46°.23; Rochester, 45°.65; Auburn, 45°.97; Canandaigua, 46°.42, which are all due to latitude and elevation. The temperature of this section of the state does not differ greatly from the mean for the whole state. It is particularly characterized for its uniformity. The average annual range of the thermometer is 96°, while in the state generally it is 104°. The greatest cold in the winter at Rochester, Lewiston and Fredonia but little exceeds that of Long Island or New-York city. Vegetation in the spring is a few days earlier than the average of the state, and about the same as at Albany. The winds of this section are 11° more southerly than the mean for the state.

The facts developed by observation in this district, show a change in climate which is probably due to a variety of circumstances. East of this district, for example, 27 places out of 32 show a lower mean temperature than is due to elevation and latitude; while here, all but two show a higher.

There is a great uniformity in the extreme heat of summer throughout the state. But 5 places out of 55, show a difference of over three degrees from the mean of the state, which is 92°. The average time for the whole state, from the blooming of the apple trees to the first killing frost in autumn, is 174 days. On the west end of Long Island it is twelve and a half days more, and in St. Lawrence county twenty-two less; the difference between the two latter, being consequently thirty-four and a half days.

The following table is annexed for the purpose of enabling the readers of this journal to make a more general comparison of the temperature of the different places spoken of in the article, with those at a distance. The allowance for elevation of the place above tide water is at the rate of one degree for 350 feet.

PLACE OF OBSERVATION.	Latitude.	Elevation.	Mean temperature as observed.	Mean temperature reduced to the standard of Albany and the level of the sea.	Calculated temperature.	Number of years observed.
Nain, Labrador,	57°08′	30ft.	26°42′	‡26°51′	25°46′	0
Quebec,	46 47	340	37 19	38 46	41 50	8
Plattsburgh, N. Y.,	44 42	105	43 97	44 73	44 96	2
Cambridge, N. Y.,	43 01	†600	45 39	47 22	47 63	14
Lansingburgh, N. Y.,	42 47	30	48 17	48 23	48 05	16
Albany, N. Y.,	42 39	103	48 27	48 64	48 26	17
Kinderhook, N. Y.,	42 22	125	46 91	47 73	48 71	13
Hudson, N. Y.,	42 15	160	48 29	48 75	48 90	10
Redhook, N. Y.,	42 02	†50	48 36	48 95	49 27	12
Kingston, N. Y.,	41 56	180	49 46	50 97	49 44	14
Poughkeepsie, N. Y.,	41 41	†50	51 65	50 88	49 81	11
Newburgh, N. Y.	41 30	150	48 96	49 59	50 10	13
Mount-Pleasant, N. Y.,	41 09	125	49 33	50 44	50 66	11
Flatbush, N. Y.,	40 37	40	51 25	51 31	51 53	17
Williams College, Mass.,	42 43	800	45 59	‡47 89	48 16	23
Salem, Mass.,	42 31	50	48 08	‡49 82	48 47	22
Newport, R. Island,	41 30	30	50 55	‡50 64	50 10	10
Philadelphia, Pa.,	39 56	30	53 42	‡53 51	54 01	0
Cincinnati, Ohio,	39 06	510	53 78	‡55 24	53 92	8
Washington, D. C.,	38 53	30	56 57	56 66	54 26	0
Natchez, Miss.,	31 28	180	64 76	‡66 27	65 50	8
Havana, Cuba,	23 10	30	78 08	‡78 17	76 39	8
Cumania, S. A.,	10 27	30	81 86	‡81 95	83 87	8
Quito, S. A.,	0 13	9510	62 00	*‡88 75	85 48	0

* Reduced by Humboldt's observations.

† Height estimated. When a place is said to be at the level of tide water, the height of the instrument is assumed at 50 feet.

‡ Mean temperature as observed, reduced to the level of the sea.

Note. The observed temperature of Nain, Cincinnati, Philadelphia, Natchez and Havana, was taken from a table in the Bridgewater Treatises; that of Washington and Newport from the Meteorological Register of the U. S. A; that of Quito from Rees' Encyclopædia, and that of places in New-York from the Regents Report.

BEDS OF OYSTER SHELLS ON THE HUDSON RIVER.

Having occasion to visit Rockland county not long since, I went ashore at Slaughter's Landing, near the great ice depôt. The shore at this place is quite steep, and closely skirted by the great range of greenstone columns, resting upon, and interlaminated with beds of the new red sandstone. This place is interesting on account of the effects which the greenstone has had upon the subjacent rocks, particularly for the remarkably distinct signs of powerful igneous action. But the facts which I propose to speak of, are the beds of oyster shells some sixty or seventy feet above the river. These beds are just below the surface of the soil in which

the large trees of the forest still remain. On inquiring of some of the gentlemen who are residents of the place how the oyster shells came here, they remarked that the common opinion was that they were brought here by the aborigines. Although the remarkable state of preservation in which we find these shells seems to favor this opinion, still, other facts go to prove that it is erroneous.

1. The shells exhibit no proof of having been burnt—the margins are entire, except where they have disintegrated from the action of the weather; both facts throw considerable doubt over the only inducement which would have led the Indians to have brought them to this place, viz. for food.

2. Among the oyster shells we find many smaller shells of different species, which are never consumed for food. But then, if we reject the common opinion of the inhabitants, what answer can be given to the question which will better explain their present position?

As the Hudson river at this place is not sufficiently saline to perfect the oyster now, it appears highly probable that these beds have been elevated above the waters of this estuary in a comparatively modern period; that the oysters lived and were associated in the same beds where we now find them, only they have been transferred from a lower to a higher level.

Oysters, it is true, still grow at this place, but they are so insipid that they are never used for food, but when taken up and conveyed to New York bay, or waters sufficiently saline, they become palatable food in the course of four years. There is no necessity for supposing that the oysters of this locality were always insipid. Let the coast be depressed sufficiently to immerse these beds, and the river from New-York up to this point would be converted into a bay whose waters would be as saline as those on the shores of Long-Island. In connection with other facts, these beds prove that within a very recent period great changes have taken place in the levels of the country skirting the sea, the coast of New-Jersey, and in fact along the whole northern and southern Atlantic board. It is not our purpose to go into a full proof of this position at this time. Facts from various quarters favor this view.

These shells, so far as they go, may be used with profit and advantage upon the land as a manure. If fully exposed to the at-

mosphere by spreading them upon the soil they will fall to an earthy state in a few years, and as their solution will take place slowly, they will furnish lime for a long time. In using them, however, it ought to be borne in mind, that if sufficient lime exists in the soil, no immediate effect will be observed from their use, especially from the outer portions of the bed where the shells have lost a large portion of their animal matter.

EXPERIMENTS.

Experiments in farming are generally made and conducted in a very blind way; so much so that they are not only worthless, but frequently injurious. Among our farmers in this country, and perhaps more or less every where, experiments are instituted from hearsay; for instance, it is reported that farmer B. has been very successful in the use of lime. But the reporter of these successful experiments, gives merely his results in connection with its use, and it appears surely that lime is a wonderful substance; and it no where appears but that lime may be used as well upon one piece of ground as another, and hence hundreds, perhaps, are led to its use on the first opportunity. Out of this hundred, ten probably will receive benefit from it, while the ninety will perceive no difference in the crops upon which it is employed. What is the cause of this discrepancy in results? Probably no question is of greater importance to the farmer than the settlement of this, and other questions of a similar character; and to this point we ask the attention of the reader for one moment.

1. If lime already exists in the soil, no perceptible effect will be observed when an additional quantity is added.

2. In order that perceptible effects may follow from the application of lime, it is necessary that organic matter should either exist in the soil, or else it should be applied with it. These two positions we believe may be considered as established. Now the farmer who has been successful in his experiments with lime, attributes all the good effects which follow its application to this substance alone; he does not give the previous composition of the land

upon which it is employed, nor the circumstances under which he has conducted the experiments. He has barely stated a naked fact, and it is left probably with others to find out the reason why, under some circumstances, this substance is sometimes useful, and sometimes apparently useless.

Again, one of the farmers, and perhaps many of them, give their testimony against lime, for they have tried it, and it was with them entirely worthless. We recollect the President of the New-York State Agricultural Society gave his experience on the use of lime. He had employed it both upon a clay soil and upon a sandy soil, and in both instances there was a signal failure, and, in our opinion, this failure in both instances was due to the causes we have already stated. In the clay there is already a sufficiency of lime—in the sandy soil there is a want of organic matter.

We have made these remarks, not so much on account of the lime, as for the purpose of calling the attention of farmers to the great importance of conducting and reporting their experiments in a systematic way, or in other words, understandingly. Now this cannot be done unless they know something about the composition of the soil. This cannot be done in a way to benefit others unless they state also the controlling circumstances under which a particular experiment has been made.. But there is one condition under which experiments have been made, which is most frequently omitted; it is that of the weather, whether the season has been wet or dry, hot or cold. It is unnecessary to dwell a moment upon the importance of noticing these facts, for the most unlearned farmer has learned that the weather influences, above all other conditions, the cultivated crops, and that whatever may be done under unfavorable circumstances of temperature and moisture, a crop will fail, at least in part, let him cultivate it in the best possible manner.

Then, again, the nature of the surface, independent of the composition of soil, will influence very materially the result of a particular mode of culture. So, also, a particular manure is of excellent service to a particular product: but from this it does not follow that it will benefit all products.

In farming, as in medicine, there are no specifics or universal remdies. There is no manure which is adapted to every vegetable. Though it is true that carbon forms a large proportion of all vegetables, yet we may get the carbon in all cases and yet not get the

crop we desire, for the sole reason that one or more special substances are wanting. From these views we advise all who are disposed to experiment, first of all to ascertain, approximately at least, the composition of the soil; 2d, to keep a register of the weather, and 3rd, to state the nature of the surface of the land—what exposure it has, and whether it is level, a side hill, or a valley, or a position between two adjacent hills.

There are many other facts and circumstances which ought to be taken into the account, but what we have said is probably sufficient to answer the end of these remarks. But lest it may be thought that we are finding fault, or are disposed to be captious, we say, in conclusion; make the experiments and give them to the public.

PHOSPHATE OF LIME AND OTHER FERTILIZERS IN THE OLDER ROCKS.

In the first number of this Journal, we gave a very brief account of the phosphate of lime, and a few other substances as they are found in the older rocks. The remarks referred to, were offered for the purpose of turning the attention of farmers to the existence of these substances simply as materials important in an economical point of view. We may however, view them in anoher light. They may be considered—in fact are considered—as special provisions made prospectively to meet the wants of organized beings. It is not in the province of these beings to create an element; all we know of their functions, proves that they only modify and combine elements. Hence that their anterior creation had a reference to future use, is certainly not unphilosophical, and if we can discover in created things prospective adjustments, they are manifested as clearly in the composition and structure of the older rocks as any where else. Coal beds are often cited in proof of the doctrine we have just stated; yet its demonstration is equally clear in the for mer, as in the latter instance. There is one fact not noticed by writers, which

is perhaps as important as any other. It is the wide diffusion of these essential elements. If phosphate of lime was confined to veins and beds, and those only of the limited extent which we usually find them, this material would rarely exist in the soil. It might abound in some places, but it would be very deficient in others. What is especially required to meet the wants of every living being, is that those essential materials should exist every where, should be universally distributed. Such is eminently the case with those four gaseous bodies which enter, it may be said, into every living thing, viz: oxygen, hydrogen, nitrogen and carbon. Oxygen, is the controlling element, its peculiar properties rendering the three others subservient to organic wants; hydrogen entering into bodies in water, nitrogen in ammonia, and carbon in carbonic acid. The diffusion of carbonic acid is an important fact—important as a provision. The atmosphere always contains it. If it is disengaged from volcanoes, it is speedily and equally distributed through the body of the atmosphere by the law of the diffusion of gases, and by winds. In consequence of its ready solubility in vapor, it is brought to the earth where it may be appropriated to the uses of plants. That there should be no want of this substance, it is largely stored up in limestones, which are not of themselves insoluble, like silica or sand. From the air, and from both ancient and modern rocks, carbon is furnished in undiminished quantities, and such is the arrangement that the sources will remain and go on furnishing all the carbon required ad infinitum, though every part of the earth may be cultivated and be made to produce double the amount it now produces.

There is still another point worthy of attention, as well as admiration, it is the condition which fits it for organization. For example, by way of illustrating the thought, had carbonate of lime been employed as the material for constituting the bones of animals what would have been the result? From the tendency of this substance to crystallize, it is believed that this form of lime would not only have formed bones of little strength, but it would requently by this property, injure the softer structures as it cannot accommodate itself to the delicate animal fibres.

We have spoken of prospective arrangements; we now remark that of all the arrangements termed prospective, all yield in im-

portance to that one which requires industry for securing the good, the absolute good, which they are capable of bringing. The tendency of the most important fertilizers is to escape and pass off into the atmosphere, or else they are insoluble or in a condition not fully adapted to the wants of vegetables. In the former case there is ammonia, which very soon passes off from the yard where animals are confined and gets beyond the reach of the owner, and we must, when this has taken place, consider it as abandoned property, or a lost material to which he has no better claim than his neighbor. To preserve it requires industry of two kinds. 1st, that of acquiring knowledge how he may best secure it; and 2d, manual industry, which consists in putting in execution the means he may have devised after he has acquired a full knowledge of the properties of the substance which he wishes to save. There is an industry which expends itself unprofitably, which consists in a continual doing but not intelligibly, and hence is wasted and consumed in mere motion. Effective industry knows beforehand what is wanted, and it proposes to itself an end, and devises means to secure those ends. The result usually turns upon the amount of knowledge which is made to bear upon those means and ends. While then, we find materials for the construction of organized beings abundant, sufficient in quantity, it is the part of the husbandman to work up these materials to the best advantage; and the fact that it requires ceaseless activity of mind and body, need not on this account be considered a faulty arrangement, inasmuch as it brings health and life in the highest degree by the fulfilment of the required conditions by which both may be possessed.

EDUCATION OF THE AMERICAN FARMER.

BY HENRY S. RANDALL, CORTLAND VILLAGE.

[We are happy to give a place in our Journal to the following article. The gentleman who thus favors us has been a county superintendent of common schools since the passage of the law creating that office; he is moreover a practical farmer, and therefore we consider his views and opinions in regard to education, as worthy of the highest consideration.]

In the January number of the Quarterly Journal of Agriculture, are submitted certain views, editorially, in relation to the topic indicated in the heading of this article, which, in the main, and especially so far as the enunciation of general principles is concerned, are, in my judgment, eminently just and seasonable. The present day is one of bold discovery and speculation. A blind veneration for antiquity no longer shields ancient dogmas and ancient institutions from investigation, and when necessary, from consequent rejection or abrogation. The true philosophy—the philosophy of progress, has become the motto of the age.

All this is well. But the progression principle should be tempered with a certain degree of conservatism. The advancing current, if kept within due bounds, will carry on its bosom a constantly meliorating civilization; if swelled to a furious torrent which spurns all control, it will, peradventure, overturn and sweep away that which exists.

In casting off old abuses, we should be careful not to consider age and error as necessarily synonymous. Our forefathers were wise in their day and generation as well as ourselves. We are not to condemn anything because it is ancient. I go a step further. I hold, as Blackstone does in relation to certain ancient laws, that anything which has stood the test of time, which has been sanctioned by generation after generation of the human family, is to be presumed good unless it can be clearly shown to the contrary. Stability is one and a strong proof of rightfulness. Otherwise no belief can attach to that most consolating and hopeful of all maxims, that "truth must prevail."

Let us not forget that were we to turn our backs with self-complacent arrogance on all the labors of the past, we, instead of oc-

cupying our present position, would roam the plains and the forests nomadic hunters—rude barbarians! In an æsthetic civilization, the ancients absolutely surpassed us; in much that constitutes modern civilization, in moral, intellectual, political and physical science, we stand in the same relation to them, that the grown up child does to the parent. The child aided by the parent to a certain point, ought, in obedience to the law of progress, to advance beyond that point. Each succeeding generation is bound to contribute its quota to civilization. But let not the last therefore spurn its predecessors, or lightly overthrow their works!

I have been led into these reflections by considering some of those propositions, ill-advised I cannot but consider them, for an improvement in our system of popular education—which also suggested the remarks of the Quarterly Journal.

It has been much the fashion, latterly, even in high places, to advocate a material education—an education having for its end the investigation of the law of physics, to the nearly utter neglect of those of psychology, ethics, and social polity.* This has been done in obedience to the maxims of a certain narrow utility; an utility which refers everything to the standard of pecuniary profit and loss; which regards man as an animal, whose prime object and chief good is to be well fed, well clothed, and well lodged; and which would therefore train him with nice care to so apply his energies and means to the attainment of these, that no jot or tittle of those means should be lost or mis-applied.

Our phase of this materializing tendency in reference to education, in the public mind, is exhibited in that assumption so popular among farmers, (since the impulse received from agricultural societies and journals has roused them into attempts to improve their knowledge of their art,) that our system of elementary education should be "practical,"—that is, that it should give them (and those in other avocations of industry?) that direct knowledge of the scientific principles upon which the processes of their art should be conducted, that they will derive tangible and "practical" pecuniary benefits from it in after life. I recently had the honor,

* I have said in "high places." In the State Normal School, where teachers are educating to mould the whole young mind of our state, neither of the last named subjects, are, so far as I am advised, taught. But singing. [illegible] are taught, carefully, and well taught!

officially, to receive a circular most respectably signed, and endorsed by a county agricultural society, urging an appeal to the legislature to establish a State Agricultural School for the education of agricultural teachers, male and female; a county school "for the education of town and district teachers," of the same kind, male and female; and lastly, "similar district schools for the education of the great mass of the people." The requisite sums to carry these several institutions into effect, to be borrowed from the common school fund. The circular urges that uniformity in teaching the various branches would thus be secured, and "the blessings of a thorough and '*practical*' education would be more generally and sooner disseminated." Other benefits and reasons are urged which there is not room here to transcribe.*

Now if "three-fourths of the effective laborers of our country are engaged in agricultural pursuits," as is alleged in the preamble of the above propositions, and if "the blessings of a thorough and practical education would be more generally and sooner disseminated" by these schools, why *borrow* from the common school fund? Shall that vast fund, the property of all, be left to educate the few—one-fourth of the people—and thus render the schools *free* to that one-fourth, (as it assuredly would, if they alone received the avails of it,) while the other three-fourths shall *borrow* a pittance from it for *their education*—to be repaid with "interest"—the "farms and buildings (of the agricultural schools) mortgaged to secure the payment of said loan"—the state and county agricultural societies held responsible for the annual interest!" Why not appropriate the avails of the common school fund at once to the support of these agricultural schools, and let the *minority* borrow and give securities for repayment? Or rather, why not convert our State Normal School into a State Agricultural Normal School, our common schools into district agricultural schools, as could be done, by changing the course of studies! What equitable or valid objection could be urged against this metamorphose, if an agricultural education is really the proper and necessary elementary education of a vastly preponderating majority of our peo-

* Among them, one of perhaps questionable interest to at least a portion of the medical faculty! One of the benefits which it is claimed would result from the course of study proposed is that "it would give such a knowledge of chemistry, anatomy, physiology, and the laws which govern the animal economy, that quackery in the healing art would cease, and many valuable lives would thus be saved!

ple, male and female ? It would be more democratic, and certainly more feasible ! So long as we find it a matter of such extreme difficulty to provide suitable teachers, fixtures, &c., to effectually carry on one system, aided by the whole avails of the common school fund, it would scarcely seem expedient to create another system, designed to meet the wants of three-fourths of the people, which should live by *borrowing*—pledged to repay the uttermost farthing !

But, after all, is our present system of education, or the course of study pursued in our schools, unnecessary ? Is that course defective, only in not embracing enough ? Could one of the studies included in it, be omitted in acquiring the most rigidly "practical," or agricultural education ? Is not reading, spelling, writing, geography, arithmetic and grammar, necessary to a farmer, or a "practical" man in any department of human labor ? If so, our present system is good enough as far as it goes. Does any one wish it to go further ? Then why not *add* to it, instead of *overthrowing* it, to substitute in its place something which must, after all, begin at the same starting point, and cover the same ground, before it can profitably advance further ?

Most enlightened men are ready to concede, that the present system does *not* go far enough—that more should be taught in our elementary schools, to prepare our people adequately for their "practical" duties and responsibilities, as men and as citizens of a free government. Now practical utility, as well as practical good sense, would certainly require that all studies shall be taken up in the order of their importance, if equally adapted to the understanding of the pupil. So long as the pupil is liable at any time to be removed, by fortuitous circumstances, forever from the school, he should first secure that which will be of most use to him. In deciding then, what additions should be made to the present course of our popular instruction, we must decide what studies rank next in importance. Are those next studies chemistry, and the cognate physical sciences, which go to make up the science of agriculture?

Before answering this question, it may be well to pause, and ask what is the true theory of education—what its end and object? In selecting the word "education"* to express that training which prepares a man for the duties of life, our forefathers showed that

* "From *e* and *duco* to draw from, or draw forth. Why not write it "*eduction* ?"

they considered it a *drawing forth* of the human faculties; and it extends to all the faculties, moral, intellectual and physical; in a word, all that goes to constitute, so far as this world is concerned, a perfect man. Practically, this order is often, I might say generally, reversed. The process of educating is made in-ductive instead of e-ductive—a filling in, instead of a drawing out. The mind of the child is treated as a piggin of certain dimensions which is to be filled with knowledge, and when so filled, the object is attained. Teachers forget that the mind, like the body, requires not only food but exercise. Should we, to further a physical development, constantly stuff the body with nutritious viands, not requiring any exercise, nay, keeping up a state of repletion that would incapacitate it for exercise, what would be the effect? A morbidly precocious development for a period, perhaps, but speedily ensuing debility and premature decay, beyond all question. Now although analogies between mind and matter are at best but fanciful, do we not oftentimes find the young mind suffered to remain inactive, and filled, through what we may consider its œsophagus, the memory—nay, crammed, as you cram a turkey with pellets of meal and treacle, until it exhibits similar phenomena! Does not a stupid and dull obesity as certainly supervene, after such intellectual as after such physical treatment! The mind, instead of being a work-shop where materials are carefully and methodically stored, with sharp, bright, and befitting tools well arranged to work them, is a garret filled with lumber promiscuously piled, where that which is wanting can never be got at. We often see these men of knowledge instead of wisdom—these "book-worms" whose vast stores of erudition is as of little use to them as the pannier loaded with gold is to the ass which carries it; and which, in some instances, seems absolutely to incapacitate them for any thing like an effective discharge of the duties of life. Like the ass, they sink beneath their load, even though that load be gold! Like the Roman Tarpeia, they are crushed beneath the ornaments they have rashly sought! Scott well paints (though perhaps verging on caricature,) such a character in his Domine Sampson—whose "pro-di-gi-ous" good qualities of heart, however, somewhat conceal, as with a drapery, the ridiculousness of the rest of the figure. Cowper, with his usual felicity, contrasts in clean and well cut relief, the bare possession of knowledge, with that full

development of all the faculties, the exercise of which constitutes wisdom.

> "Knowledge and wisdom, far from being one,
> Have ofttimes no communion. Knowledge dwells
> In heads replete with thoughts of other men;
> Wisdom in minds attentive to their own.
> Knowledge a rude unprofitable mass,
> The mere materials with which wisdom builds,
> 'Till smooth'd, and squar'd, and fitted to its place,
> Does but *encumber* whom it seems to *enrich*."

We have not enough of education in this country to have many Dominie Sampsons; but we have much of the same education in kind, the *cramming* system, on a small scale. I was shown a little prodigy a few days since, who could, to the astonishment and delight of parents and teachers, repeat the contents of his geography from beginning to end. A specimen of this recitation was vouchsafed me. He stated of some country, "that its climate was salubrious and its soil fertile." I asked the lad the meaning of the word "climate." The reply was, "I don't know, sir!" "What does 'salubrious' mean?" "Don't know, sir!" What "fertile?" "Don't know!" Our schools are filled up with such prodigies, our country with such parents and teachers.

The great object of education is not to *fill* the mind with bare facts—abstract knowledge: it is to *train* the mind, to *discipline* it, *develop* all its energies and resources, as the body is trained and disciplined and developed in the gymnasium, until every sinew is firmly knit, every muscle hardened and strengthened to its utmost limit. Knowledge is a valuable *incident* in this course of mental training, but it is not the first object nor the main object. In selecting a study we should certainly, other things being equal, make choice of the one which would unite valuable knowledge with mental discipline. Arithmetic, English grammar, and many others belong to this class. But to sacrifice the great and primary object, for the purpose of obtaining what is miscalled a "practical" education, namely, a knowledge of the processes of the art which is to constitute the future occupation of the learner, is to consult a narrow utility. It is penny wisdom, and pound foolishness. This knowledge should be *superadded* to mental and moral culture. Its importance can scarcely be over-estimated in such connection. National and individual wealth and comfort much depend upon it, and it supplies the pecuniary means necessary to upbuild institu-

tions even for mental culture. But which is of the most importance, in the economy even of this world, the *man* or the *workman*—the mind or the purse? Do we live only to go unceasingly through one constantly recurring round of labor, like the miserable beast in the bark-mill, and are we to be trained only beast-like to perform that duty well, or do we live to enjoy those higher attributes of intellect which has allowed us to ascend to a position "but a little lower than the angels!"

Most fully do I concur with the editor of the Quarterly Journal, that the lawyer, the mechanic, and the farmer, all require a similar elementary training *in kind*—and to this I would be glad to add, *in degree*. The same preparatory discipline is requisite to give to the farmer or mechanic a vigorous and well balanced mind, that is to give it to the lawyer or clergyman. And is it less necessary? Is any farmer prepared to subscribe to the humiliating doctrine that education, beyond that necessary to fit him to labor advantageously, and transact business decently, is of no avail to him—that it is his business to go through life uninstructed only in his handicraft, a sort of a food-producing machine for another class, who are to think for him—to legislate for him—in short, to use him as a voluntary helot—a sort of upper or privileged beast of burthen? If there is such a farmer, he deserves to occupy the position which his downward aspirations so grovellingly claim!

Why shall not the farmer's habitation be the abode of taste and intelligence? Why shall not Bacon and Shakspeare come and converse with him? Why shall not history and poesy and science, shed the informing and refining influence over his domestic circle? Are these Utopian dreams? The farmer has but to *will* it so, to have it so! He is the tax-payer—*he can be the legislator!*

But whether it is by legislation, or other means, that our schools are to be brought to a condition to confer such a culture on the farmer, the first step must be to add to instead of subtracting from his mental culture—to enlarge, instead of diminishing his course of disciplinary studies—to build up and extend and improve institutions having such culture and discipline for their object, instead of overthrowing them in quest of that pseudo utility which places dollars and cents before intellect—before the dignity of human nature.

Make our schools what they ought to be. Place them under the direction of competent instructors. Have the branches now taught in them taught philosophically—taught as they should be. Introduce into them other necessary studies—studies which will still further train and discipline the intellect. Add to these those which will cultivate the taste. Introduce moral culture, and, finally, teach young republicans political science—the science of government, political economy, and political ethics. All these are more important to the man and the citizen, particularly the citizen of a republic, than the knowledge of any or all arts or handicrafts. Thus I answer the question propounded in the preceding part of this article—"whether the *next* study to be engrafted on the present course of instruction in our schools, should be agriculture?

But when we have formed the *man*, it is assuredly well to form and instruct the *work-man*. After the farmer has attained the sound thorough education, e-ductive and in-ductive, above hinted at, it certainly behooves him to acquire the science of his own art. How shall this be done? Shall the study of agriculture be engrafted on the course of common school education? Not yet; perhaps never. It will take a long period to bring teachers and schools in a fit condition to teach, or to learn it, without sacrificing that which is more important. More erudition than is *now* contained in our common schools, would be necessary to understand even the *terms* of Liebig, Boussaingault, Paen, &c. Even the common, the necessary elementary branches now taught in them, are not generally well taught. They are taught by rote, as the parrot is made to repeat its phrases. If we would play the part of true reformers, and not of men run away with by a hobby, let us begin at the foundation. In spite of those swelling eulogiums which it is the fashion of Executives and Heads of Departments to lavish on this branch of our polity, he who has made himself familiar with the schools in any extended section of our country, in the "by places" as well as the "high places," cannot but feel the need, the deplorable need of reform. Scarcely a tithe of the scholars who receive their *only* education (so far as schools are concerned,) from our common schools, ultimately leave those institutions any thing like thorough proficients, even in the branches now commonly taught in them, viz: reading, spelling, writing, geo-

graphy, arithmetic and grammar! In what condition then are such schools—such teachers and scholars—to take up a science, the study of which involves the study of many, if not all the natural sciences? In what condition are they, for example, to discuss and decide upon the rival theories of Saussure, Paen and Liebig? "Make them capable," is it said? This must be a work of time; I fear not a short time. Even when those indispensable elementary studies above enumerated, are thoroughly taught and acquired in our schools, there are still, if preceding positions are not false, other branches of instruction which would claim precedence of agriculture, as superadditions to the present course. Is it said that we should not wait for perfection either in the tuition or acquisition of present branches, before we introduce others which are concededly necessary? This is granted. But would it do to add *all* that are necessary at once? Does any one hesitate to decide that such a procedure, supposing it possible in the present state of public feeling among the proprietors of the schools, would lead to inextricable confusion—utter inefficiency? Then let us make our additions to the present course of study gradually, seasonably, and in the order of their importance. Let agriculture wait its "turn." We may be permitted to hope that turn will ultimately come, and peradventure, if the proper means are employed, not tardily. If we would accelerate the period, those means are obvious; our path is a plain one. We cannot do it by a zeal which embraces but one, out of all the benefits sought. We must unite in a vigorous and continuous effort to improve our common schools *in all respects*—to raise them to that pitch that they can take up the study of agriculture understandingly, and without the sacrifice or neglect of any thing more important.

The next point to be discussed is whether the study of agriculture can be profitably introduced into our higher schools—our colleges and academies—by the institution of professorships, as proposed by the editor of the Quarterly Journal? Of this there can be no doubt. These institutions are not elementary in their character. They have, or should have, the necessary chemical apparatus, geological specimens, &c. The scholars in them, it is to be presumed have finished their rudimentary education, or if not, that

under the regulations of such institutions,* they will take up studies in their proper order.

The question now occurs, can these institutions, by the establishment of the proposed professorships, do all that can be properly *now* done—all that is feasible, in the premises? Differing from the editor of the Quarterly Journal, I think not. I see no objection in theory or practice to the establishment of a State Agricultural School, with an experimental farm. There can be no more impropriety in legislating and appropriating the public funds, to instruct our people in an art from which three-fourths of them directly derive their subsistence, than to teach a few of them a profession.† The theory of legislation would be in both cases the same, to wit: the promotion of the general good. No one in his senses, surely, will deny that whatever tends to promote that branch of industry which gives food and raiment to man, which physically, at least, sustains and lies at the bottom of all the other avocations of industry, promotes directly and tangibly the general, the universal good.

With such a school—with the proposed professorships in our higher institutions—and with the agricultural press, I would at present leave the work. Knowledge is diffusive in its tendencies, especially in a republic. If the means proposed do not enough, we can gradually add to them. But let no rash hand attempt to overthrow our present system of elementary education, to build up in its stead a system having for its object specially the education of those of any art, or trade, or profession! To adopt the sentiment of a gifted son of New England,‡ let our common schools remain the broad platform where the sons of the rich and the poor —those of all arts, trades and professions, shall start in the career of honor and usefulness together.

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* Our academies do not prescribe courses of study. But there is an influence generally, and should be always, exerted by their teachers, which results in the same thing.

† Our medical colleges are directly endowed by the State.

‡ Henry Barnard, 2d, Esq. of Rhode Island.

NEW PUBLICATIONS.

Geological and Agricultural Report of New-Hampshire, by C. T. Jackson, M. D.

This report, which is published by order of the Legislature, is in one quarto volume of 375 pp. It is very well printed on good paper, and is illustrated by maps and diagrams. Dr. Jackson has executed his work with ability, and the Report itself shows upon its pages that he is a thorough field-geologist, and can master all the intricate local questions in this department, as well as those general problems of geological dynamics, which are often so difficult and perplexing. We should not, however, do justice to the author of this work, if we failed to state, that we consider the Report as eminently practical; and is, especially on this account, of great value to the farmers of New England, or wherever it may circulate. We therefore propose to give a pretty full analysis of the work, that our readers who are not able to procure it, may be put in possession of some of the important results of this survey—especially the agricultural part of it—a part in which they will probably feel the most interest.

The rocks of New-Hampshire, as it appears from this report, belong almost entirely to the primary class; or to that class which is destitute of organized bodies. So far as Dr. Jackson's investigations go, petrifications are not found in any rock, except in the tertiary class, which occasionally appear on, or near the coast. The argillaceous slate, a rock of sedimentary origin, and resting upon gneiss and mica slate, is found in Hinsdale, Winchester, Chesterfield, and a few other towns. On the Vermont side, it furnishes roofing-slate, which, though not so smooth and fissile as those of Maine and New York, yet, are very strong and durable. Still higher in the series is a conglomerate, the new red sand-stone, of an era just posterior to the coal-formation; it however only borders the slate, without crossing the line. It is found in Northfield, Mass., near the south-western corner of the State. We have no more to say, at this time, of sedimentary rocks.

From these few facts, it will at once appear, that the great interest in the geology of New Hampshire, lies in the valuable minerals associated with primary rocks. Of those minerals, Dr.

Jackson has selected the most common, and given their composition—for the purpose, in part, of showing the necessary composition of the soils—for it is from their decomposition that the soils of the state are entirely formed.

Thus, by knowing the composition of the mica, feldspar, quartz, and hornblende, we obtain a proximate knowledge of the soil which the rocks containing them will certainly form by decomposition. Thus, feldspar contains silex, alumine, iron, and potash, and sometimes soda and lithia—an alkali analogous to soda. Mica, also, contains one of the alkalies. Soils, then, derived from those bodies, will probably contain—at least in their original condition—those elements, nearly in the proportion in which they exist in the rocks, or in the minerals composing the rocks.

The most important metallic minerals of New-Hampshire are the oxides of iron, sulphate of zinc, copper, and arsenic; and oxide of tin. Iron has been profitably manufactured at Franconia, from the magnetic ore. In Bartlett, very large veins of this ore have been discovered. Zinc, though it has never been made in this country, Dr. Jackson has very satisfactorily proved may be, at a moderate profit, at least. The tin ores have been discovered in Jackson in sufficient quantities to repay the expense of extraction. The tin ores are in veins, and are the first, and in fact, the only ones which have been discovered in this country. It is a mineral which is very liable to be overlooked, from its want of that strong metallic lustre peculiar to most metals and ores. It always occurs in the primary rocks, and hence a very large proportion of New-York may be set down as entirely destitute of this valuable substance. In fact, there is very little probability of its occuring at all, even in our primary formations.

Among the earthy minerals which are profitably wrought, are mica, granular quartz, soap-stone, lime-stone, novaculite or hone-slate, granite and gneiss. The number of localities at which these minerals occur, produces an industry and enterprise quite commendable, and it is interesting to know, that in formations similar to those of New-Hampshire, that the sources of revenue are quite numerous. One great error, however, is in the disposition to overlook and undervalue all objects, except those which look as if they might contain gold or silver. The geological surveys,

however, in all the states, as well as in New-Hampshire, have had a tendency to break up gold-hunting, and to turn the attention of landholders to those substances which, though far less showy, are more useful and profitable, if explored upon the right plan. If no other objects have been gained by geological surveys, the facts and information which have been freely communicated, are worth to community as much as they have cost.

In addition to the geological information, Dr. Jackson has measured most of the mountains of the state, with great care; and has, without doubt, obtained very accurate results. The following are the heights of some of the most important mountains of New-Hampshire:

		Feet.
Mount Washington,		6,226
Camel's Rump Mountain,		3,615
Gunstock	"	2,447
Carr	"	3,381
Chocarua	"	3,358
Piquaquet	"	3,358
Ossipee	"	2,361
Red Hill,		2,000
Connecticut Lake,		1,624

We subjoin the following list of minerals, which we believe will be interesting to the lovers of this department of Natural History.

Acworth. Beryl, rose quartz, albite, tourmaline.

Westmoreland. Sulphuret of molygdena, phosphate of lime, oxide of molybdena in the small cavities of the mass.

Alstead, mica, tourmaline. *Charlestown.* Andalusite and staurolite macle.

Unity. Sulphuret of copper and iron, in a vein in gneiss, running N. 10° E., titanium, chlorophyllite, (N. S.,) octahedral iron, green mica, actynolite, garnet.

Jackson. Oxide of iron, in veins running N. 80° W. and N. 60° E.

Hanover. Almandine. *Wilmot.* Beryl.

Oxford. Clove brown tourmaline in large crystals, and in radiated masses. *Piermont* micaceous specular iron ore in veins, running N. 15° E., in which are masses of barytes, and green, white and brown mica, and phosphate of lime.

Haverhill. Copper and iron pyrites, blende, native arsenic and arsenical pyrites, large crystals of garnet, and magnetic and white iron pyrites.

Franconia. Magnetic iron in veins running N. 30° E., 3½ to 4 feet wide, manganesian garnet, hornblende epidote, copper pyrites *Eaton.* Vein of blend six feet wide, running N. 27° E., galena, containing silver in the proportion of one pound to one thousand pounds; copper pyrites. *Hillsborough.* Graphite.

Francestown. Soapstone. *Dunbarton.* Arsenic in a vein. *Randolph.* Andalusite macle.

Amherst. Pargasite, egeran and cinnamon stone, garnet in limestone, amethyst, magnetic iron. *Richmond.* Soapstone, quartz, feldspar, phosphate of lime, pinite, rutile, pyrites, garnet, hornblende, anthophylite, iolite.

Having stated some of the facts relating to the geology and mineralogy of New-Hampshire, we pass to that part which treats of agricultural geology and chemistry. We omit, purposely, a notice of the part which treats of metallurgy, at this time, intending to furnish our readers with some of the information upon this subject, in a future number. Agricultural geology and chemistry is divided into five heads. Under the first, Dr. J. treats of the mineral ingredients of soils, and of their distribution; under the second, of the nature and origin of the organic matter of soils and the saline ingredients accompanying them; under the third, of the substances found in plants; under the fourth, of those taken up from the soils by the crops; and fifthly, of the best method of restoring fertility to exhausted soils. Under the first head, it is maintained that soils originate from the rocks by disintegration and decay, and that the nature of the rock determines that of the soil; and as an illustration of this position, Dr. J. refers to the soil of mica slate, as differing from a granitic soil; the former being far more silicious, more highly charged with alkaline ingredients, and as being warmer and more retentive of moisture. The following is the composition of a fine mica slate, and granite soil:

	Mica Slate Soil.	Granitic Soil.
Water,	3.6	6.8
Vegetable matter,	5.4	1.8
Silica,	79.2	84.4

	Mica Slate Soil.	Granitic Soil.
Potash,	2.2	trace.
Peroxide iron and alumina,	5.6	6.8
Soda,	2.5	"
Lime,	3.2	0.3
Magnesia,	1.2	0.8
Loss,	0.1	0.0
	100.0	100.0

Hornblende and sienite make, also, a much better soil than granite, and trap rocks, than either, as it decomposes more rapidly, and furnishes the alkalies, potash, soda, lime and magnesia; while, at the same time, it is warm and light.

Argillaceous rocks give origin to a tough blue or brownish colored soil, and is cold and heavy; but is capable of being improved, by underdraining and admixture of sand. Limestone soils differ from the above, as much as the nature of the rock itself differs from it; though the lime is often removed by filtration and solution, and by the action of plants, when it contains principally the silicates and alumina.

Under the second head, it is maintained that those plants which abound most in inorganic matter, were first formed, as lichens, ferns and the grasses. These plants laid the foundation for organic matter in the soil, as they would consolidate a sufficiency of carbon to furnish the mould for other plants. Plants of the higher orders, when grown in pulverized quartz, with saline matter only, do not produce seed, though the foliage grows well. When the plant dies, a mould or humus is formed, and the next crop perfect their seeds. Peat has a similar origin with mould; that is, from the death of plants, as the mosses, growing in water together with the leaves, stems and roots of other vegetables. Peat preserves wood and even animal matter from decay when wholly submersed; but when atmospheric air has access to those matters, they decay. Peat contains nitrogen, phosphate of lime, and sometimes phosphate of magnesia. Sometimes peat spread upon soils exerts an injurious effect, from the presence of free acids. Some salts, as copperas, and sulphate of alumina, are present in excess; these exert an injurious effect. These facts explain to us why it is, that some farmers are justly prejudiced against peat as a ma-

nure ; but we see, however, that the difficulty is easily remedied by the alkalies, as lime, soda and potash.

3. *Organic Matters of Soils.* Vegetables, by decay, undergo in the process a species of fermentation, and are ultimately converted into acids, which combine with the leaves and earths in the soil. This is a different result than that obtained when the decay takes place in bogs, as here there is rarely an alkaline or earthy base with which they may combine. In a pure silicious soil, those salts are not found ; and in those we see the necessity of adding ashes, lime, ammoniacal manures, &c. The turning in of green crops does not suffice in these cases. The following organic matters, according to Dr. J., are always present in soils, having obtained them from soils procured in every quarter of the world.

1. Crenic acid and crenates. 2. Apocrenic acid combined with bases. 3. Humic acid. 4. Humin, or undecomposed vegetable matter. 5. Extract of humus. 6. Another extract, not named ; and 7. Phosphoric acid combined with lime, alumina, or magnesia.

Origin of Saline Matter in Soils. These are traced distinctly to the mineral kingdom. The vegetable acids which form soluble salts in the earth, are formed from the constituents of the atmosphere and water—as carbon, oxygen, nitrogen and hydrogen.

The saline matter of plants having mineral bases, are always present, but vary their proportions in different parts of the same plant, as well as in different kinds of vegetables. These saline bodies are derived solely from the soil. The following analysis shows the relative quantities of those bodies in two very different plants :

	Red Raspberry Bush. Ashes.	Indian Corn. Ashes.
Silica,	0.25	38.45
Phos. of lime,	3.65	17.27
Carb. lime,	3.40	2.50
Potash,	5.24	13.82
Soda,	0.50	trace.
Oxide manganese,	1.00	——
Carbonic acid and loss,	2.16	——
Phos. of potassa,	——	2.25
Carb. magnesia,	——	2.16
Sulphate of lime and magnesia,	——	0.79
Silica, mechanically present,	0.0	1.70
Alumina and loss,	——	165.

The phosphates, which are always present in corn, are, however, distributed unequally in the kernel. The chits, for instance, contain a larger proportion than the other parts; thus the chits yield, on analysis—

Phosphate of lime,	2.4
" magnesia,	0.8
Phosphoric acid and a little silica, potash, and oxide of iron,	3.2
	6.4

By soaking a kernel in various chemical solutions, the different elements may be tested; thus the tincture of iodine colors the starch blue, sulphate of copper colors the phosphatic portions a pale green, forming with them a phosphate of copper. In this way Dr. Jackson has tested directly the presence of the most important bodies in Indian corn. A colored lithographic plate is given upon which this new and interesting mode of analysis is very satifactorily shown. The proximate elements differ in quantity in the different kinds of corn, or maize. Tuscarora corn contains the most starch, and rice corn the least. Rice corn contains the most oil, and Tuscarora corn none. The small Canada corn ranks next to the rice corn in this particular. The presence of oil confers the property of popping, as it is called. The oil serves to prevent fermentation in the grain—Tuscarora corn meal sours very soon—whereas, the meal of flint corn will keep sweet for years; the former forms a good light food for horses, but not for fattening hogs. Too much oil in corn makes a dry bread, and hence requires the presence of gluten to stick it together. The proportions of oil in corn vary from six to eleven per cent. From the presence of the above elements, it is seen why corn is such an excellent food.

1. It has abundance of starch for respiration and sustaining animal heat.

2. An oil for the fattening of animals.

3. Phosphate for the bones. We see too, from these facts, how horses may be overfed by the rich grains; the phosphates which they contain being supplied in greater quantities to the system, it is deposited as extraneous matter in the limbs of the animal.

On the Improvement of Soils.—To reclaim a soil from barrenness, or to improve one of moderate fertility, Dr. J. remarks, re-

quires an insight into the nature of those agents most active, and universally present in fertile soils. The ingredients which occur in the most minute proportions, are those upon which its fertility depends. Silica, alumina, lime, magnesia, oxide of iron, and manganese, potash, soda, phosphoric acid, chlorine, and a certain proportion of disorganized and partially decomposed organic matter, appear to be the most common and universal constituents of soil. But the state in which these bodies are combined, and the condition of the organic matters, decide, not unfrequently, between barrenness and fertility. Light sandy loams need a heavy top-dressing of leached ashes, after which, they will produce abundant crops. When a soil is properly charged with a limed compost, gypsum is an excellent fertilizer, and should always be sown broadcast, with clover, which serves to retain the ammoniacal matters disengaged from nitrogenized manures by the action of lime.

Pulverized granite is a good amendment to clayey soils. When there is a deficiency of lime, it may be supplied in a compost with peat, either in the form of marl, or of slacked lime.

The alkalies are best introduced by means of ashes in a peat compost.

Magnesia is to be employed in combination with an acid, as the sulphate, or phosphate. Magnesian earth may be applied with profit to soils containing an excess of the sulphate of iron arising from the decomposition of pyrites.

A mixture of peat, urine, a little epsom salt, lime, and gypsum, will make an excellent fertilizer to almost all kinds of soil.

Salt acts as a powerful fertilizer, especially on soils remote from the sea. It causes an increased growth of foilage, and gives the plant more strength, so that a much larger crop of grass is obtained where it has been spread. It should not be used in larger quantities than from three to four hundred pounds to the acre, and it is best to mix it into compost while adding the recently slacked lime, for it will serve to retain the ammonia.

Phosphates of soda, potash, magnesia, ammonia, and lime, are all powerful manures, and enter largely into the composition of plants. Phosphate of lime is obtained from burnt bones.

In noticing this report, we have perhaps exceeded the proper limits; but as few copies only of the work are printed, we were

anxious to extend the information it contains. We now take our leave of it for this time, intending, however, to take another opportunity for completing our analysis of its contents.

VESTIGES OF THE NATURAL HISTORY OF CREATION.

Republication, by Wiley & Putnam. 12mo. pp. 291.

"He has sometimes hinted that man might perhaps have been naturally a quadruped; and thinks it would be very proper that at the Foundling Hospital some children should be enclosed in an apartment, in which the nurses should be obliged to walk half upon four and half upon two, so that the younglings, being bred without the prejudice of example, might have no other guide than nature, and might at last come into the world as genius should direct, erect or prone, on two legs, or on four."
The Idler.

That curiosity which prompts us to search into the nature of those agencies which have been concerned in arranging the constituent materials of the earth, or the character of those laws which preside over the development of animate bodies, ought not to be styled frivolous or vain. That such inquiries often carry us beyond the pale of experiment and observation, is freely admitted; still, if we are within the province of reason, we may get from her those responses which can not be given by an experimental philosophy. She may, it is true, give us indistinct replies; or, her answers may not remove every doubt, yet we may be assured that they will be neither absurd, nor conflict with experiences well determined.

As a mind once awakened, though perhaps only partially enlightened, will rarely fall back into a state of apathy; so, one that is fully aroused can hardly be expected to tread the beaten track; yet, it seems to be true, that there is less occasion for running into absurd speculations now, than at any former period. In some minds, however, the imaginative powers are so largely developed, that they preponderate over those of sober observation; and hence, the equipoise between them being destroyed, they are prone to mistake speculation for demonstration; or else, are easily satisfied with a very few facts hastily snatched up by the way.

We do not deny, however, that we are often pleased in the perusal of speculative works, even though they belong to that class which may be styled unproductive; yet we prefer that they should

be drawn up in the language of inquiry, and that they should be compatible with common sense. With these characters, we will not object to them, though they may land us upon what may be considered, by some, as heterodoxical ground. As with flint and steel the latent fire is stricken out, so, by the collision of minds, truth is elicited ; hence, we say, strike ! burn your tinder, that peradventure your blaze may illuminate those spaces where light has never before penetrated.

The "Vestiges of the Natural History of Creation," is the title of an English publication, which has recently been re-printed in this country, the perusal of which, in our case, has excited a variety of emotions, of which the pleasurable have, upon the whole, preponderated. The design of the author in this work, is to overthrow the commonly received doctrines of the origin of man, and the numerous species of living beings which people the earth, the air, and water ; or, perhaps, it is more agreeable to the general tenor of the work to say, that it calls in question the validity of the prevailing opinions upon this subject.

The main points which are attempted to be established, are, that a series of changes in animals and plants has taken place, by which they have advanced from lower to higher grades ; that these changes have been effected by the influence of physical agencies, and in which they were controlled in their upward progress by the conditions of the medium in which they were immersed. Man, for example, came first into existence as a monad or simple cell ; but has since advanced by ordinary generation from this humble rank to his present exalted station, having passed through a series of changes, the different stages of which are represented by the molusca, fish, reptile, and quadruped.

The proofs adduced in support of this hypothesis, are derived mainly from geology ; especially from those observations which seem to favor the doctrine that the beings entombed in the rocks, taken together, form a series of advancing types from the simplest to the most complex ; from the low to the high, when viewed as to time—the most advanced belonging to the period just anterior to the present,—the simplest and lowest, to the period most remote.

Having stated thus briefly the design of the work, and the foun-

dation upon which it mainly rests, we proceed, more in detail, to consider some of the data upon which the doctrines are based, that we may estimate the value of the author's positions, and determine for ourselves how far they are entitled to belief.

The first 44 pages is a preliminary exposition of the arrangements of the universe of matter, in which he treats particularly of the bodies in space—of their formation—of the depth to which the earth has been penetrated—of its outer envelopes or coats, as the primary rocks denominated granite, gniess, mica slate, etc. Thus far, the doctrines of this work agree with those of the best informed observers of the day, and may be passed over without comment. The next section, however, entitled "Commencement of organic life—sea plants, corals," etc., demands a passing notice. The position assumed in this section, is, that carbon appeared upon the earth simultaneously with organic beings, as the following extracts show, page 45 : "Limestone is a carbonate of lime, a secondary compound of which one of the ingredients, carbonic acid gas, presents the element *carbon*, a perfect novelty in our progress.:" Again, page 46 : "It is not easy to suppose that at this period carbon was adopted directly in its gaseous form into rocks; for, if so, why should it not have been taken into the earlier bodies also?"

"Again, it is stated from Delabeche, that the quantity of carbonic acid gas locked up in a cubic yard of limestone, is equal to 16,000 cubic feet—and the quantity locked up in coal is also enormous—and it is supposed that if this enormous quantity was disengaged, or set free, it would prove destructive to animal life—but, says our author, a large proportion of it must have been, at one time, in the atmosphere. The results which we observe, are perfectly consistent with, and may be said to pre-suppose, an atmosphere highly charged with this gas, from about the close of the primary non-fossiliferous rocks, to the termination of the carboniferous series, for there we see vast deposits (coal) containing carbon as a large ingredient, while at the same time the leaves of the *Stone Book* present no record of the contemporaneous existence of land animals."

Two important affirmations are made in the above passages; 1st. That carbon and organic beings appeared simultaneously upon the earth. 2d. That the atmosphere, during the period included

between the formation of the primary rocks, and the termination of the deposits of the coal rocks, was so loaded with carbon as to have been incompatible with the existence of land animals.

First, as it regards the contemporaneous appearance of carbon and organic bodies—on this point, we say, that there is no element so well entitled to the character of *primary*, as carbon. In New-England and New-York, it exists in combination with lime, forming with it limestone, which, if position is proof, is one of the oldest of our rocks. Immense beds of this material are every where associated with granite, hypersthene rock, and gniess, and under these conditions, which by no rational interpretation can be referred to the era of the sedimentary rocks containing fossils; inasmuch, too, as these beds are often revealed by their destruction, where they appear locked in between beds, or masses, declared on all sides, as the primary rocks of the globe, and hence the limestone beds, their associates, have the same title to the appellation of primary, as any of the deeper rocks composing the earth's crust. What is there in limestone, which, as a rock, makes it incompatible with the primeval condition of the earth? Why should it not, like granite, form a constituent part of the primeval globe? We wish it to be understood, then, that what the author asserts in regard to the contemporaneous appearance of carbon and organic beings, has no foundation in facts. The geology of New York bears us out in an unqualified contradiction.

Having disposed of one of the points at issue, we proceed to the second, viz: that a far greater quantity of carbonic acid existed in the atmosphere in the interval between the primary schists, and the termination of the coal formation, than in the subsequent periods. On this point, we feel a greater difficulty in finding the direct proof which is calculated to silence a caviler, than the first; for many persons seem ready, and even determined to believe any thing, provided, it is sufficiently marvellous.

As our author, however, has based his doctrines on statements which pass for truth in England, all we have to do, is to make known what has been discovered in this country; which, when interpreted by his own rule, if it does not establish a position directly the opposite, will, at least, take away the whole force, point, and bearing of his argument.

It is assumed, for instance, that all the carbon now taken up

in the coal beds, existed in a free state in the atmosphere during the whole period antecedent to their formation; and hence, the atmosphere was rendered irrespirable by land animals. The main fact, and probably the only one, which favors this doctrine is, the the supposed non-discovery of the remains of these animals in rocks of the coal series, or those which are nearly cotemporaneous with them. It will be admitted, no doubt, on all hands, that it is dangerous, in all cases, to found a position on a negative; especially, in the observational sciences, for we know not how soon some fortunate discovery, or it may, perhaps, be called unfortunate in one sense, will entirely upset the best constructed theory; certainly such is the case in regard to this part of the author's assumption. If the supposed absence of land animals in the rocks just referred to, is sufficient in itself to give weight to the view, that the atmosphere was irrespirable previous to the period of the coal deposits, certainly the discovery of facts proving their existence, ought at least, to nullify the assertion, or take away all weight and value to an argument formed upon such a premise. But, be that as it may, the existence of land animals is as clearly proved in the coal era as in that of the new red sandstone. We allude now to the discovery of foot-marks of birds and quadrupeds deep in the rocks of the carboniferous series, in Pennsylvania, by Dr. King. The observations seem to have been made with proper care, and to be as much entitled to our belief as those which have been made in the system of rocks above them, viz: the new red sandstone of the valley of Connecticut river. From this representation, then, we do not perceive that there is sufficient ground for what the author asserts in regard to the condition of the atmosphere, in the period referred to; and hence, so far as such a view may be considered as bearing favorably on the hypothesis of organic progress, as developed in the vestiges of creation, we cannot for ourselves, see that it has much if any weight. We dwell no longer upon the points specified above, inasmuch as it is sufficient for our purpose, to show that in this country carbon appeared as a constituent of the rocks, long anterior to organic beings; and that so far as the condition of the atmosphere is concerned, we have no occasion for basing an hypothesis on a negative position, in as much as we have that proof which warrants almost the assertion that the atmosphere was as respirable in the period of

the coal deposit, as in the succeeding era, that of the new red sandstone.

It will be inconsistent with the plan of the Journal to notice in detail the views of the author, as they are successively developed in his sketch of the progress of animals and plants. It is sufficient to say, that, in all that portion of the work which treats of the organic developments in the eras of the old red sandstone, carboniferous, and new red systems, and also the oolite, cretaceous, and tertiary formations, we find nothing sufficiently erroneous to call for special remark, except in one or two facts, from which it appears that fish occur in older rocks here than in England. The bearing of this fact upon the author's hypothesis, is, to destroy that coincidence which he supposes may exist between the development of the fœtal brain and that of animal life as it has appeared upon the globe.

We now pass to the chapter which treats of the origin of the animal tribes, where we find that the author's view of one subject at least, calls for remark. It is the view which he presents of aboriginal or spontaneous production of living bodies, wherein he has assigned a production independent of generation. The first position assumed is, that the lowest types of organization, the intestinal and visceral worms, (entozoa,) for instance, are produced spontaneously, or at least independently of the ordinary process of generation, within those structures which they inhabit. The necessity of resorting theoretically to this mode, is the difficulty of gaining access to these structures by any thing from without; particularly by ova or eggs, from which insects invariably arise. It is supposed that any minute particle of organized matter, as a flake of lympth, may, under favorable circumstances organize itself; that is, not only maintain an independent vitality, but may create viscera and organs so far as to constitute an individuality. The proximate cause of life in the vestiges of creation is electricity; hence, without the impulsive electrical force, no atom can be vitalized so far as to become a specific being; from this it follows, that all similar structures must be vitalized by electrical forces also, for, in all animal bodies, are entozoa or worms. We are aware that the subject is one deeply obscure and profound; and we do not profess to know anything at all of matter, and yet we have a right to inquire, whether, since there are so many cases where it is proved that

worms are conveyed into the system from without, and are generated in the ordinary way, ought we not still to adhere to the common notions; the bot, in the horse is a good example, whose production may illustrate in a general way what takes place in any given instance.

The second position assumed, is, that production and organization is the result of an electro-chemical force. To sustain this view of the origination of vitality and of an organized structure, he has recourse to the electrical experiments of Mr. Crosse, in England, under whose eye insects appeared in a saturated solution of silicate of potash, (flint dissolved in potash.) The remarks of the author are exceedingly curious, and we think he will say so himself when he comes to reflect upon them. We transcribe them from page 141: "In the apparatus, the silicate of potash became first turbid, then, of a milky appearance; round the negative wires of the battery dipped in the fluid, there gathered a quantity of GELATINOUS MATTER—A PART OF THE PROCESS OF CONSIDERABLE IMPORTANCE, CONSIDERING THAT GELATINE IS ONE OF THE PROXIMATE PRINCIPLES, OR FIRST COMPOUNDS OF WHICH ANIMAL BODIES ARE FORMED ! !" Silicate of potash turned into gelatine or glue! This exceeds the expectations of the alchymists of old. The transmutation of the baser metals into gold, would not have been half so marvellous and wonderful. Whether the author intended to deceive, or lead astray for the purpose of giving plausibility to his doctrine, we cannot tell; certainly, so far as we have learned, none of the philosophers of England have ever gone so far as this, or have given such an interpretation of Mr. Crosse's experiments.

We have now reached that part of the work for which all that precedes it, seems to have been preparatory; and which was required to enable the author to give a plausible exposition of his peculiar views of organic progress on the globe.

This part is termed "Hypothesis of the development of the vegetable and animal kingdom." We have already anticipated some of the main points of this hypothesis; still, it is necessary to observe that it is based partly on physiology and partly on geology. Geology is supposed to furnish the following facts, viz: that the older rocks abound in fossils; they all belong to low types of organization, but they never contain the higher, in virtue of certain changes upon the earth favorable to their production. But let the Vestiges of Creation speak for itself, pages 153-4: "The whole

train of animated beings, from the simplest and oldest up to the highest and most recent are, then, to be regarded as a series of advances of the principle of development, which have depended upon external physical circumstances, to which the resulting animals are appropriate." The nucleated vesicle* is the fundamental form of all organization. The first step in the creation of life upon this plant was a chemico-electric operation, by which simple germinal vesicles were produced. The first step being taken, an advance was made under favor of peculiar circumstances or conditions, from the simplest forms of being to the next more complicated, and this through the medium of the ordinary process of generation;" that is, if we understand the author, any individual of a species, may, or all simultaneously under peculiar conditions, generate a species a step higher in the scale than themselves, or in other words, create a being—for certainly it is a creation. At the first view, such an idea bears the aspect of impiety—but the author softens very materially this construction in preserving the agency of Deity by the instrumentality of law, through which, the creation proceeds—a law, emanating from the great Architect of worlds.

The author, by this law, avoids the common notion of creation, which seem to suppose that in every creative act there has been an immediate instrumentality of Deity, like that of man, in his works. We do not charge impiety upon the author in this hypothesis. If, however, other readers know more of creative power, or of the modes by which species have been created, or of the reason why they have appeared successively upon the earth, by this hypothesis, they are more highly favored than ourselves.

Anatomical considerations militate against the law of development proposed by the author. In the calculating machine which changes its law after the 100,000,001, there is a special construction and adjustment of the machine by which the law is changed, at this stage of its action, and these special parts of the machine, whereby the law is changed, may be seen within it; it is a part of the original workmanship. But no provision can be discovered in the human machine for changing the law of production and generation.

If the calculating machine, by its own mechanism, can generate the special apparatus for changing its law, then we might infer

* A vesicle containing granules of matter, which are successively advanced in their turn to vessels also.

that the human frame, as a machine, might at any time generate within itself those parts which would raise it to a type specifically higher or lower than itself. But we know of no such provision. Whenever a species stands above or below another, though in the same group, it is supplied with additional parts, or else there is a modification of parts unknown to those near to which it stands.

In a machine which can change its law by the development of structures within itself, it would be impossible for any finite mind to know what it might produce—its law could be understood only by infinite intelligence; certainly, the human machine is not intended thus to work. The development of sex, does not come within this form of the law; the change of stamens into petals, by feeding, and other analagous changes, is a very different matter from that of change from species to species. The development of the queen bee, by an instinctive management of the workers, is but a part of the economy of the bee; the queen of the bee is produced, but they cannot produce a queen of any other species of bee: much less a wasp or hornet.

The work, from the 179th page, and onwards, to its conclusion, is devoted to an exposition of the Macleay system of animated nature, the early history of mankind, the purpose and general condition of the animated creation, and the mental constitution of animals. We can cheerfully recommend those subjects to the reader; they are well treated and worthy of a careful perusal.

We have, however, in conclusion, a few remarks which we have reserved for this place. We take upon ourselves the responsibility of saying, that geology lends only a feeble support, if any, to the peculiar views of the author so far as they relate to organic progress.

There are some analogies in the vegetable and animal kingdom, which may be brought in incidentally, which have a remote bearing upon the subject. Thus a barren soil first produces a green mould; next, mosses, and the larger plants of this class, and finally shrubs and trees. So, in the earlier periods, the seas produced (it may be) only the humbler animals, which vegetated, as it were, like the mould and the mosses of an unfertile spot of earth. But what does this amount to, if proved? Mosses and mould, as well as well polypi and monads, are the humble tenants of the soil and of the waters now; and the great and the humble com-

mingle now in the same medium, both are products of the present. He who assumes that the early inhabitants of the seas were unfitted for the present, assumes what he can by no means prove. It is merely a bold assumption. We say again, what we have said on former occasions, that, because certain animals do not consume, apparently, as much of some of the elements as others, it does not follow that, if the atmosphere or water contained less, they could exist in one or the other; it is certainly an inquiry of great consequence. In the Vestiges of Creation we find no less than five important assumptions which are erroneous. 1. That carbon and organized beings appeared simultaneously. 2. That limestone was first laid down in the lower part of the Silurian system. 3. That the condition of the atmosphere, anterior to the coal era, was loaded with carbonic acid. 4 and 5. That land animals and dry land appeared only subsequently to the coal. Contrary to the above assumptions, we have found vestiges of land plants, at least as early as the Oriskany sandstone. And besides, though we have high authority against us, we believe that in no period in the earth's history has dry land been wanting. In fact, we are inclined to adopt the opinion that the seas of the earlier sedimentary matters were deeper than the present; for how, on other grounds, can we account for the great thickness of the slates and subordinate rocks of the Cambrian or Taconic system?

This book contains a few facts practically important to the farmer. They are such as prove that the perfection of all animals, is dependent upon proper conditions—upon a sufficiency of light, air, nourishment and temperature. The lower animals do not pass through their proper metamorphosis if deprived of light. The tadpole, for instance, does not become a frog, if submersed too deep in water: the absence of light and a lower temperature, both combine to prevent the natural development. The human family, in fact, when occupying unwholesome places and are poorly fed, produce a larger proportion of monsters, or of imperfectly developed offspring, than when surrounded by comforts, and living in a pure atmosphere. Domestic animals, in their turn, must suffer from similar causes. Fine horses become blind and are often lost by being kept in badly lighted stables. Economy and humanity, then, require the farmer to guard his animals against disease and imperfection by suitable provisions for their comfort, sustenance,

and convenience. It is by following out the law of development that perfection in breeds is attained; which consists mainly, in providing for such wants as the nature of the animal demands. Or to be more specific, in furnishing an abundance of food suitable to the age, and giving it at the same time, air and exercise; exempting it from hardships which prey upon the physical powers, surrounding it with luxuries compatible with its organization, and finally, combining with all, a kind moral treatment.

INSECTS INJURIOUS TO VEGETATION—No. I.

We commence with this number a series of articles upon the insects which are injurious to vegetation, with the hope and expectation that we shall be sustained in this new feature in an agricultural journal. We do not mean to say that insects have not been the subjects of investigation before, nor that they have not been written upon; but we mean to say that suitable descriptions, with correct and colored figures, have never been given in any of our agricultural publications. For ourselves, we believe this is the only mode which can be eminently and extensively useful. We need say nothing of the importance of the subject, for we are sure that there can be only one opinion, viz: that it is one of the most practical, useful, and important subjects to the agriculturist, especially when it is known that the number of injurious insects increases, and that they extend their ravages wider and wider every year. To counteract their ravages, we must first know them; then, their habits must be studied and well understood. We are then prepared either to destroy them, or evade their attacks upon our property.

Genus, *Saperda*, Lat. Plate III. fig. 1. Head vertical, as broad as the thorax, flattened, body cylindrical; inferior lip straight without notch or remarkable fissure; thorax cylindrical, without lateral spines; antennæ filiform, and terminating in an elongated joint.

S. tripunctuta.—Color, deep black; fore part of the breast, top

of the thorax, rusty yellow, and two black elevated dots on the middle of the thorax, and a third dot on the hinder edge close to the scutel; wing covers are coarseiy punctured, in rows on the top, and irregularly on the sides and tips, each of which is slightly notched, and ends with two little points.*

Observations. This insect finishes its transformation towards the end of July, and lays its eggs early in August, one by one, on the stems of the blackberry or raspberry. The grubs burrow directly into the pith. The plant withers and dies the same summer.

S. bivittata.—Fig. 7. Upper side of the body marked with two white longitudinal stripes, between three of a light brown color; face, antennæ, under side of the body, and legs, white.

Observations. This insect is the great pest of the apple tree, quince, mountain ash, hawthorn, and shadbush. The larva have been found in the trunks of all these trees, and the insect itself feeding upon their leaves.

That our readers may see the importance of watchfulness over their orchards, we subjoin a few extracts of a letter of the late Jesse Buel, upon this pest, of May, 1825.

Mr. Buel says that he was sent for a few days ago, by Mr. Heartt, of Troy, to witness the devastation made in a fine young orchard, by a grub hitherto unknown to farmers, and which correctly to know, and to be able to guard against, is a matter of great public interest.

It appears from this letter, that the orchard was injured much more seriously in that part which had a warm southern exposure and was situated upon a steep declivity. The whole damage which was done to this single orchard, was estimated by Mr. Heartt, the owner, at $2,000.

The larva, in this instance, entered the sap-wood just beneath the surface, and then cut its way upwards. The grub, after having undergone its transformation, which requires about three years, escaped through the bark by a perforation about thirteen inches above the surface. Sometimes they were so numerous in a single tree as to destroy the whole circle of sap-wood.

* A large proportion of the specific descriptions and observations are copied directly from Harris' Massachusetts Report. The editor has no merit, except in giving accurate figures of the insects.

The larva are fleshy, whitish grubs, nearly cylindrical, and tapering a little from the first ring to the end of the body; head small, horny, and brown. It comes forth from the trunks of the trees a perfect insect, like No. 7, early in June, making its escape in the night. In the day time it is at rest among the leaves of the tree which it devours.

Dr. Harris considers the constant re-appearance of this borer in our orchards and nurseries is owing in a great measure to the carelessness and inattention of individual owners. Old trees are suffered to remain, which are full of the insect in its larva state; or, they suffer the suckers to choke the base of the tree, and furnish a harbor so long as they remain unpruned.

Two or three methods have been resorted to for destroying this insect. 1st. By a wire thrust up into its hole. 2d. Cutting it out with a gouge. 3d. Plugging the hole with a piece of soft wood, to which Dr. Harris advises the use of a few grains of camphor. The first method is the safest. The gouging, if resorted to, ought to be performed with great care. In all cases, however, the suckers ought to be cut, removed from the field, or burned. The worst of cases we have seen of the ravages of this pest, have been those where the tree has been shaded and choked by suckers. The dampness, together with the exclusion of light, seem peculiarly favorable for the increase and propagation of this insect.

S. calcarata.—Body covered with a close short nap; color, fine blue-gray punctured with brown, and with four ochre-yellow lines on the head, and three on top of the thorax; wing covers tipped with sharp points.

Observations. This is the largest of our Saperdas. The grubs infest our native, as well as the Lombardy poplar, which last it has nearly destroyed. They are of a yellowish white color, except the upper part of the first segment, which is of a dark buff. When fully grown, they are two inches long; body thick, and larger before than behind, and consists of twelve segments separated from each other by deep transverse furrows.

The beetles may be found on the trunks and branches of the various kinds of poplar, in August and September; they fly by night. (Harris.)

Gen. clytus.—Body elongated; antennæ shorter than the body. Thorax globose, unarmed; hind legs clavate.

C. speciosus.—(The beautiful clytus.) Head yellow; thorax black, with two yellow transverse spots on each side, or rather parts of bands; wing covers black, the rest yellow; the black curiously banded with yellow, in the form of W, and the inner parts of the same letter; besides these, a yellow spot on each shoulder, and complete yellow band convex downwards; the yellow part banded black, convex upwards, with two dots, one on each side.

Observations. This is the largest known species of the genus clytus. Its larva destroys the sugar maple, by perforating its trunk. The eggs are laid upon the trunk of the maples in July and August; the grubs, as soon as hatched, penetrate the bark; the next year, they penetrate deeply into the wood, forming many sinuous passages.

In order to destroy the grub, Harris says they must be sought for in the spring, when they may be detected by the saw-dust from their borings, before they have penetrated deeply into the wood, when they may be destroyed by thrusting a wire into their holes; or by the judicious use of the knife. When young maples are seen to languish and loose their thrift, let them be examined for this insect.

C. pictus.—Body, black, ornamented with transverse yellow bands, three on the head, four on the thorax, and six on the wing covers; tips also edged with yellow; the third band is a W; the others may be described as zig-zag—or all looking more or less like a W; legs, rusty red.

Observations. In September they gather upon the locust-trees, when they pair; after which, the female deposits her snow-white eggs in crevices in the bark. The eggs are soon hatched, and the grubs immediately burrow into the bark, the inner side of which they soon devour; there they remain torpid during the winter; when the spring opens, they penetrate the wood, in irregular winding passages. Their works may be known by the saw-dust cast from their holes, and the oozing of sap. The effect of the wounds caused by these grubs, is to produce swellings in the trunk and limbs, and such a weakness of the woody texture, that it is unable to maintain a resistance to the winds. The grubs attain their full size by the 20th of July, when they soon become pupæ,

and then beetles, and finally they are ready to leave the tree in September.

The principal means for destroying this insect, seem to be that of gathering it in September, when they congregate upon the locust tree, to pair. Mr. Harris expresses the opinion, that an hour devoted to this business for a few days, would be sufficient to rid us of it; and if followed up for a few years, would be the means of saving this excellent tree from ruin. Heading down the tree, in some instances, may be necessary.

C. caprea, fig. 5. P. III. Fuscous; thorax, with the anterior edge, yellow; elytra with four bands and tip, yellow. (Say).

Observations. The elytra at base are marked O. O. The two remaining bands arched upwards, and all at equal distances from each other; two yellow dots at their tips.

Say remarks, that the bands are sometimes white. The larva, like the preceding species, are supposed to live in wood.

Desmocerus, P. III. fig. 6. Cerambyx of Forster: Stenocorus of Fab. Eyes lunated, surrounding the base of the antennæ; head sloped before; palpi terminated by a large joint, in the form of a reversed, elongated, compressed cone; labrum very apparent; maxillary larger than the labial palpi; thorax almost square, or cylindrical—generally spinous or tubercular on the sides; antennæ long and setaceous. (Stark.)

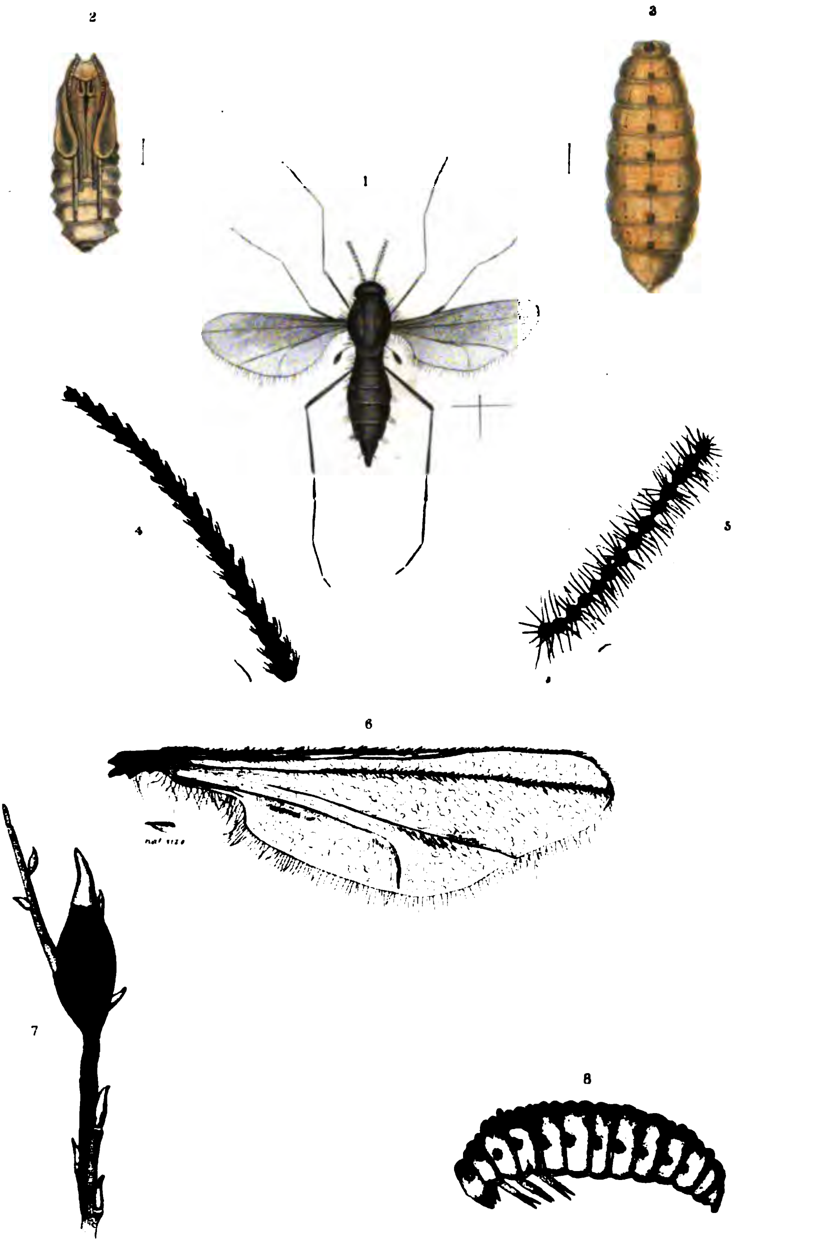
D. palliatus.—Color, deep violet, or Prussian blue; nearly one half of the wing covers orange-yellow; antennæ have a knotted appearance.

Observations. The larva live in the lower part of the stem of the elder, and devour the pith. This insect is rather useful than injurious, by destroying this troublesome shrub.

Fig. 2. Pl. III. Purpuricenus: Dejean. We are unable to give a satisfactory account of this insect; it will therefore be noticed in some subsequent number.

NOTE.—The valuable plates accompanying this number of the Journal, were engraved by our friend J. E. GAVIT, Bank Note Engraver of this city, which—considering that it is the first attempt in this line of business—does him much credit as an artist.

Plate 2



A. Fitch, Del.

J. E. Gavit Sc.

1 Cecidomyia salicis

2 Pupa

3 Larva

4 Male Antennæ

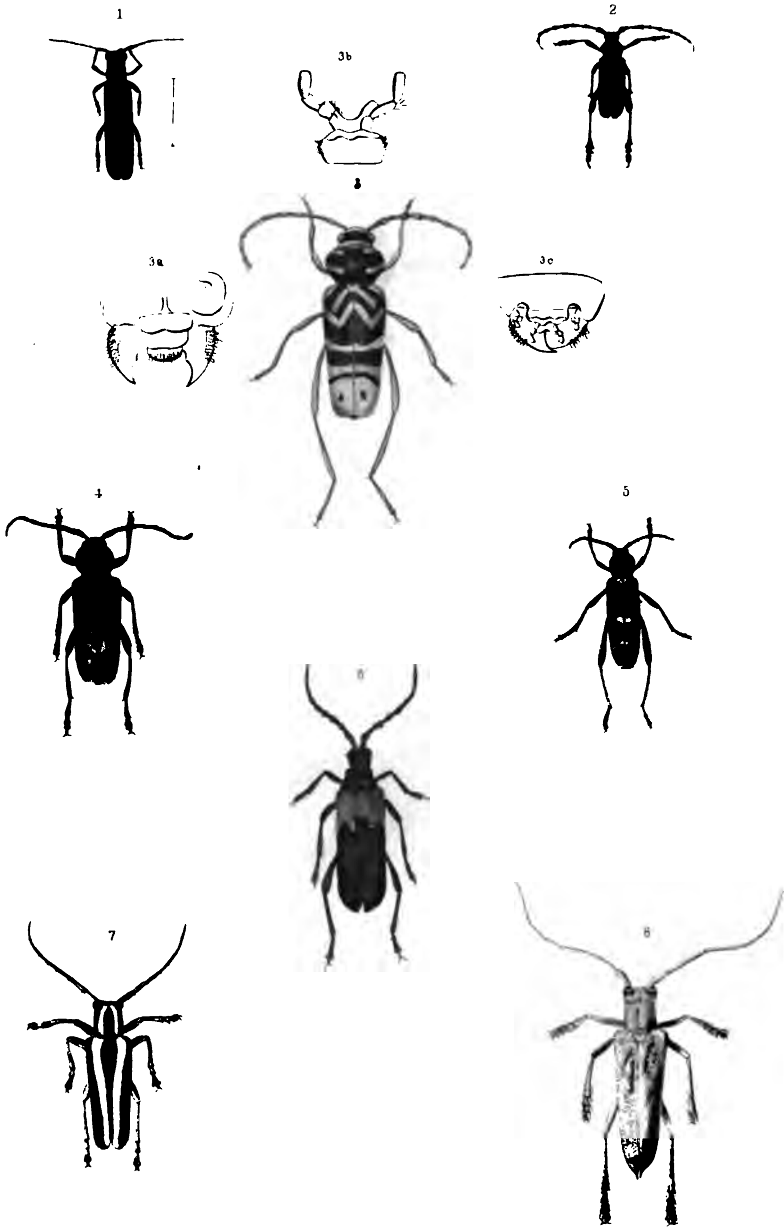
5 Female Antennæ

6 Wing

7 Gall of C. salicis

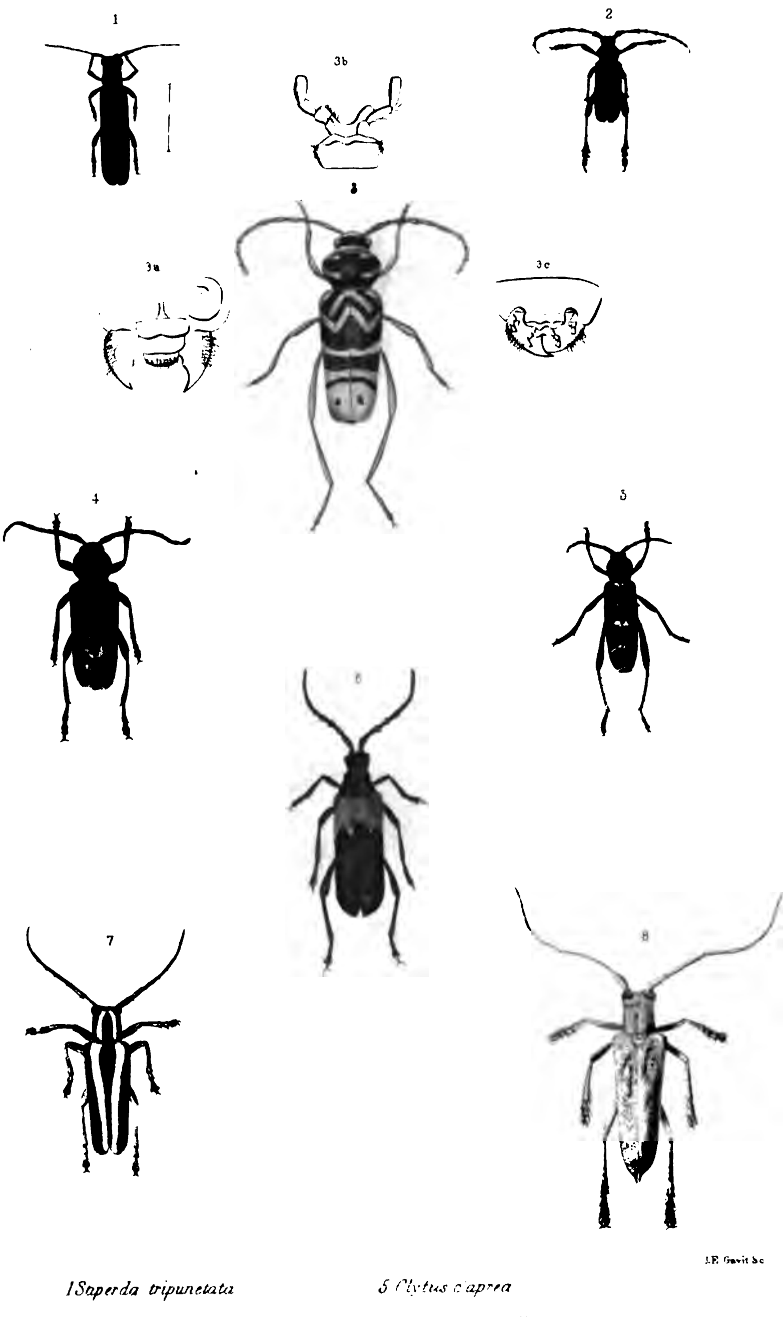
8 Destroyer of C. salicis

Plate 3.



E. Emmons Del. 	J.E. Gavit Sc

1 Saperda tripunctata | 5 Clytus caprea
2 | 6 Desmocerus palliatus
3 Clytus speciosus | 7 Saperda bivittata
4 " pictus | 8 " calcarata



S. Emmons Del.

J.E. Gavit Sc

1 *Saperda tripunctata*

2

3 *Clytus speciosus*

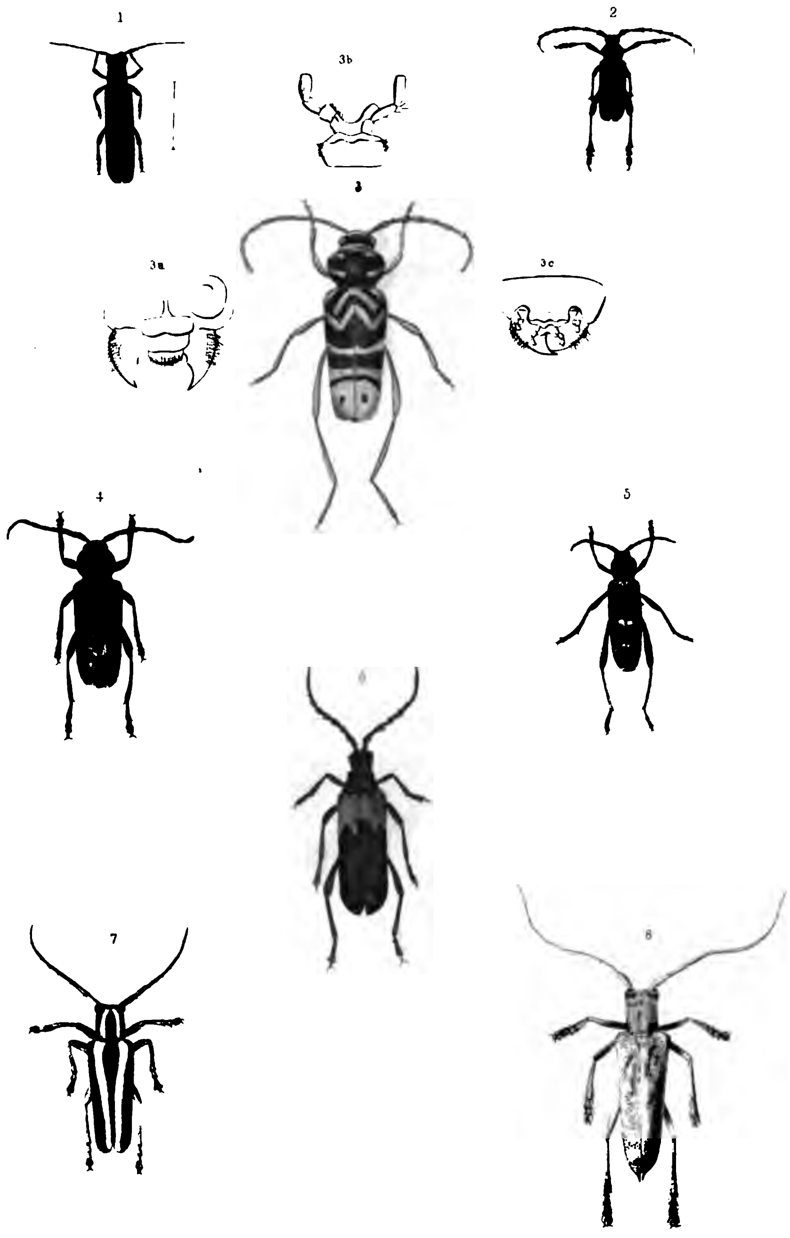
4 " *pictus*

5 *Clytus caprea*

6 *Desmocerus palliatus*

7 *Saperda bivittata*

8 " *calcarata*



E. Emmons Del.

J E Gavit Sc

1 Saperda tripunctata

2

3 Clytus speciosus

4 " pictus

5 Clytus cuprea

6 Desmocerus palliatus

7 Saperda bivittata

8 " calcarata

INSECTS INJURIOUS TO VEGETATION.—No. 2.

INSECTS OF THE GENUS CECIDOMYIA, INCLUDING THE HESSIAN AND WHEAT-FLY.

BY ASA FITCH, M. D.

It is the design of the articles, of which the present forms the commencement, to lay before the reader as full and accurate an account as the writer's investigations and means of information will enable him to do, of a genus of insects, which, in consequence of the ravages which some of its species annually commit, justly ranks first in importance in the consideration of the tillers of our soil. This design consequently embraces a precise statement of the different marks which characterize each species in the several stages of its existence; its habits and instincts; the depredations which it commits upon the particular kind of vegetable which it inhabits; the most approved measures for lessening or preventing its depredations, together with a description of the natural enemies of each species, which aid in keeping it from becoming excessively multiplied. In the course of these communications, it is hoped, that some contributions may be made of interest and value, both to the cause of agriculture and of science.

INSECTS ALLIED TO THE CECIDOMYIÆ.

Preliminary to entering upon a consideration of the particular species of this genus, it is important that we ascertain with precision what characters belong to the group of insects with which this is classed, and what are the marks by which an insect pertaining to this genus may be clearly distinguished from its closely allied associates. Though nothing original will be embraced under this head, it is presumed that what it contains will still be valuable to those persons residing in rural districts, and therefore most favorably situated for making observations, but who at the same time have access to no large public library, containing those works on natural history from which full information respecting the natural alliances of these insects may be obtained. Any one not well acquainted with, or overlooking these generic and family marks,

will be very liable to consider a number of insects to be cecidomyiæ, which in reality belong to some of its kindred genera.

The genus cecidomyia belongs to the order DIPTERA, of systematic works. This order includes all those insects which have but two wings, and which are known in our common language by the names "flies" and "musketoes." Gnats, midges, and some other names, are given locally to some of these insects, but are not in general use in our country, and consequently convey no definite ideas to the great mass of our citizens.

All the insects of this order undergo what is termed a perfect metamorphosis—their eggs hatching to footless *larvæ*, commonly called maggots or grubs, and these having attained their full growth change to *pupæ*, in which state many of them resemble a seed or an egg, and some surround themselves with a kind of silk-like cocoon. From these pupæ the perfectly formed and fully grown flies eventually come out.

A large number of the insects of this order are obnoxious to man in a variety of ways. Some suck his blood, their poisoned wounds producing pain, succeeded by an itching and swelling of the part. Some teaze and torment him, by pertinaciously alighting upon the uncovered parts of his body, or swarming upon the viands spread upon his table. Others deposit their eggs upon his domestic animals, that their larvæ may live upon or within their bodies; as, the horse-fly, bot-fly, sheep-fly, ox-fly. Others still, produce larvæ which injure vegetation to a greater or less extent; as, the radish-fly, onion-fly, cabbage-fly, pear-flies, fruit-flies. But, as if to counterbalance for these pests, this order also furnishes many species which render us special services, by feeding upon and destroying noxious species—by devouring putrid animal and vegetable substances, which might otherwise poison the air we breathe, &c. How forcibly do such facts portray the importance of our becoming acquainted with this class of beings, that we may know which are our friends and which are our foes—which to cherish and which to destroy.

Of the several family groups comprised in this order, the genus under consideration pertains to that named TIPULIDÆ, being composed of those insects originally embraced by Linnæus in his genus Tipula, a name in use among the ancients to designate some kind of water-spider, and not inappropriately bestowed upon these

insects, their long legs being analogous to those of the spider, and their light airy structure enabling many of them to alight and walk upon the surface of water, without sinking into it.

This family, in many respects, closely resembles that of *Culicidæ*, to which the insects which we call musketoes belong. Both these families are distinguished from all other two-winged insects by their antennæ or horns, which are somewhat long and thread-like, that is, of much the same diameter throughout their entire length, and composed of at least six, and generally, as many as fourteen or sixteen joints—the other two-winged insects, which would all be designated as flies, in common parlance, have on the other hand but two or three short, thick joints to their antennæ, with a small but conspicuous bristle usually proceeding from the side or tip of the last joint. The long and slender body, small, round head, and legs remarkably long and slim, are other marks by which the Culicidæ and Tipulidæ are readily known. They fly, moreover, both by night and day, but when by day, mostly in shady and moist situations. When flying, their legs are generally extended for the purpose of balancing the body, though this renders their progression slow, compared with that of most other insects when on the wing. Many of the smaller species are accustomed to collect together in swarms in the air, and flit about in a kind of dance.

The Culicidæ are furnished with a long, projecting, thread-like proboscis, or sheath, containing a sucker composed of about five minute needles, enabling them to pierce the skin and suck the blood of the larger animals. This is the prominent distinguishing character between them and the Tipulidæ; the latter having no proboscis, or but a short and feeble one, bent downwards towards the breast, and incapable of being advanced forwards and serving the purpose to which it is applied by the musketoe.

The Tipulidæ then, possess at most only a muzzle or short proboscis, containing but a pair of needle-like threads, so weak that this organ seems only adapted for sucking up the exposed, or but slightly covered fluids of particular vegetable tissues. The perfect insect, in reality, exhibits but a slight inclination for food of any kind. The family appears to be well marked, and natural; its several members presenting an aspect strikingly analogous to each other, and resembling that of the well known musketoe. Of

its subdivisions, proposed by different authors, those of Latreille appear to be the most natural, and are the ones most referred to at the present day. He divides the Tipulidæ into five subordinate groups, each differing somewhat from the others in the form of the perfect insects, and still more in the habits of the larvæ. These groups are briefly characterized, as follows :

1. Aquatic Tipulides. Antennæ entirely covered with hair. Larvæ live in the water.

2. Terrestrial Tipulides. Head elongated into a muzzle. Larvæ inhabit the earth, mostly living on the roots of plants.

3. Fungivorous Tipulides. Two or three ocelli; trochanters elongated; tibiæ strongly spurred. Larvæ feed on mushrooms.

4. Tipulides of gall-nuts. No ocelli; trochanters of ordinary length; head not prolonged to a muzzle; antennæ moniliform, clothed with short and scattered hairs. Larvæ generally feed in galls formed on vegetables.

5. Floral Tipulides. Antennæ short, perfoliated, of from only eight to twelve joints; legs of ordinary length. Larvæ in dung-hills; perfect insects on flowers, said to eat their buds.

GENERIC CHARACTERS.

It is to the fourth of the above groups that the insects under consideration pertain. All the insects comprised in this group are distributed in the following genera, the most prominent distinctive characters of each being appended.

CERATOPOGON. Antennæ with a tuft or bundle of hairs at their base.

PSYCHODA. Wings furnished with numerous nervures.

CECIDOMYIA. Wings with but three nervures.

LESTREMIA. Like Cecidomyia, but antennæ only fifteen-jointed, and the first tarsal joint elongated.

The wings and antennæ, then, it will be perceived, furnish the characters by which the genus cecidomyia is distinguished from all the other Tipulidæ. The *antennæ* are always longer than the head, and frequently as long as the body; they are slender and thread-like, and composed of sixteen joints or more, each joint being of a rounded and often globular form, and, at least in the females, verticillated with short hairs; that is, having a number of hairs placed in a row around the joint, like the spokes of a wheel in its hub. In the males, the number of joints is commonly twenty-four, and these are clothed with minute hairs, but not always verticillated.

The *wings*, when the insect is at rest or walking, are not inclined in the form of a roof, as they are in the genus Psychoda, but repose upon the back in a horizontal direction, like those of

the common house flies, the inner edge of one wing lapping over that of the other. Another yet more distinctive mark is found in the nerves or ribs of the wings. These are but three in number, running lengthwise of the wing, diverging from each other as they proceed backwards, and giving off no smaller or subordinate branches or veins. In most of the species, these nerves terminate before they reach the edge of the wing. This neuration of the wings appears to distinguish the Cecidomyiæ and Lestremiæ from all other insects, a genus of the Terrestrial Tipulides, named Lasioptera, being the only one allied to them in this character, that possessing but two similar nervures.

Other characters may be mentioned as more or less common to the Cecidomyiæ. The head is hemispherical in its form ; the palpi or feelers are short and inconspicuous ; the eyes are crescent-shaped ; the two first joints of the antennæ are often perceptibly shorter than the others ; the wings are generally transparent, shining and glass-like, reflecting the tints of the rainbow ; the legs are long and slender ; the tarsi, or feet, consist of five joints, of which the first is quite short, and the second long.

Habits.—The females of most of the species, have the body terminated by a sharp point ; in several, it is prolonged into a tube or ovipositor, the joints of which shut into each other, like those of a telescope. By this instrument, it is enabled to pierce the young leaf or flower buds of trees or plants, and place one or more eggs therein. Each species is led by instinct to a particular part of a certain kind of plant, which alone it selects as a home for its young. The egg hatches into a footless larva or maggot, which subsists upon the juices, or upon the substance of the bud, and the irritation which it produces, causes an increased flow of the fluids of the plant to this part, which thus grows to an extraordinary size, and forms a kind of excresence, called a gall. They agree in this part of their habits, with the Cynips, a family of four-winged flies, one of which produces the well known nut-galls of commerce. In the interior of this excresence the maggot dwells, and having acquired its growth, it becomes a pupa, and like most other insects in this stage of their existence, takes no nourishment, but lays dormant in its cell for a definite period of time, at the end of which, it changes to a fly, and makes its passage out of the gall. Some of the species, probably, leave the

galls, and enter the ground, ere they assume the pupa form. The larvæ of a few, which infest grains and grasses, do not produce galls, but lie concealed between the natural clefts of certain parts of those plants.

It is a singular and interesting fact, that these minute creatures, all so nearly alike in their colors and appearance that the naked eye can scarcely detect any difference between them, will go forth and each select for itself a particular part of a particular plant, in which to deposit its eggs; one choosing a leaf-bud, another a flower-bud, another the tender bark of the young twigs, and another it may be, the bark of the roots, or the petiole, or the nerves of the expanded leaf. Equally singular is it, that the eggs, all minute as grains of sand, and often precisely alike in form, color, and substance, will from one species, produce an excrescence always of a globular form, like a grape or bullet; another ovate, or shaped like a bird's egg; a third oval; a fourth knobbed and warty; here with a smooth surface, there prickly; now soft and succulent, again hard and stony; being thus so exactly marked in every instance, as to enable the naturalist to tell with certainty the particular species that will proceed from any particular gall that presents itself to him. *O Jehovah, quam ampla et miranda, sunt tua opera!*

FOREIGN SPECIES.

Twenty-six different species of cecidomyia are enumerated by Mr. Stephens as occurring in Great Britain. Most of these, and others in addition to them, are found upon the continent. A short account of the habits of some of these cannot but be interesting to the general reader, and will be particularly valuable to the agriculturist, as giving him a more enlarged acquaintance with a group, some of which yearly inflict upon him such severe disasters, and all of which rank among those insects which are injurious to vegetation.

One of these species (*C. Juniperina*,) infests the common juniper of Europe, forming its galls at the tips of the twigs. These galls are composed of six leaves, the three outer ones being larger, and enveloping the three inner ones. Baron De Geer has studied out and described the mode in which the galls come to be thus constructed. He observes that the natural leaves of the juniper are always placed in rows around the stem, each row being composed

of three leaves, and that the tips of the young shoots always end in three leaves,* these last often inclosing three others which are smaller, and which envelop the bud which is destined to produce a new shoot. Within this bud the cecidomyia deposits its egg. The larva that comes therefrom subsists upon and destroys the bud, but spares the leaves by which it is enveloped, which leaves, by receiving a portion of the juice destined for the bud, become developed to an extraordinary size. The galls thus formed, boiled in milk, are a popular remedy for the whooping-cough among the peasantry of Sweden, who hence name them *kik-bar*, i. e. cough-berries. Though these galls are found at all seasons of the year, it is only during the cold months, from September till May, that they contain the larva. This is a footless worm, about the twelfth of an inch long, of a bright orange color, rather broader posteriorly, and composed of twelve rings. It changes to a pupa in May, which retains the same color, but is shorter and broader, being of an oval form, and its head is furnished with two small conical eminences like horns. The perfect insect crawls out of the gall, at a small opening formed at the tips of its inner leaves. It is of an ash-gray color, with white wings, the margins of which are fringed with hairs.

De Geer also discovered the pupæ of two other species, which were enveloped in cocoons attached to the leaves of the pine. One of these cocoons was composed entirely of a yellowish-white silk, and suspended by threads of the same kind; the other had, in addition to the silky envelope, an exterior coating of a resinous and white substance. The larva by which this is formed, differs from most of the larva of this genus, in having two rows of pointed nipples resembling feet, to the number of fourteen. To escape from the cocoon, the pupa detaches from one of its ends a small portion like a lid.

The lotus, the vetch and the willow, are others of the European plants which often exhibit those singular monstrosities, the galls of the cecidomyiæ. The flower-buds of the lotus swell and expand till they resemble bladders with a pointed apex, yet their petals never appear. The young branches of some willows have irregular excrescences formed upon them, sometimes rounded, sometimes elongated; in short, varying considerably in their external appearance, and of a ligneous or woody texture within. Their surface

exhibits the shrivelled vestiges of some of the buds which have failed to expand their leaves, and have withered in consequence of all the juices destined for their growth having been absorbed by the gall. These remains of buds form small holes, which communicate with the interior of the gall. The pupæ pass the winter season enveloped in cocoons within these galls, and when about to change to their perfect or fly state, glide by little and little along the channels produced by the perforations of the buds, to their mouths, whence they emerge upon the wing. The extremities of other twigs of the willow, stung by another species of cecidomyia, shoot forth a dense tuft of leaves, resembling a double rose in their appearance, though retaining their green color, or like the fruit of the hop. These singular appendages were very perplexing to the earlier botanists, some of whom regarded the trees on which they grew as distinct species from those on which they do not happen to occur. Gerarde thus characterizes one of the English willows as bearing something like roses, which make "a gallant show—being set up in houses for the decking of the same, and yielding a most cooling aire in the heat of summer."

AMERICAN SPECIES.

Hitherto but two species appear to have been noticed in this country, to wit: the Hessian fly, scientifically named and described by our accomplished and indefatigable naturalist, the late Thomas Say—under which name, however, the recent investigations of Miss Morris seem to render it not improbable that two distinct but closely related species may have been heretofore confounded—and the wheat fly, probably identical with the *C. tritici* of Europe, but which has not as yet been so accurately traced out and described in this country, as its importance demands. But that there exist within our boundaries a number of other species, no one acquainted with our Entomology, and consequently aware of the little attention that has been as yet bestowed upon our Dipterous insects, will doubt. Their minute size, the short period of their existence after attaining their perfect state, the obscurity of their retreats, and their seldom being much upon the wing during the day time, are circumstances that have enabled them to elude the researches of those few individu-

als who have devoted their attention to collecting and describing our American insects.

At the commencement of the past summer, an early species of grass, called "June grass," in this vicinity, was in several situations prematurely destroyed, soon after flowering, the stalks from some one of the joints upwards, withering and turning to a straw color, and to such an extent that one person informs me, on casually approaching his meadow one morning, it presented so white an appearance, that his first thought was that it was covered with hoar-frost. The connection of the stem immediately above the joint, seemed to be entirely destroyed, so that the slightest force withdrew it from its sheath, by which alone it continued to be sustained in an upright position. From the analogy of this affection, to that produced by the Hessian fly in wheat, I infer it to have been probably caused by a kindred species of cecidomyia.

Though my attention has not been directed to the detection of additional species till since the commencement of the present year, three species have already occurred to my notice. The larva of one of these inhabits the buds of our common alder; another occurs upon the sides and the third upon the tips of willow twigs, each of them producing those excrescences denominated galls. I have not as yet succeeded in forcing forward into its perfect state, and am therefore prepared to give an adequate account of but one of these.

CECIDOMYIA SALICIS. (PL. II. FIG. I.)

Black; hirsute; wings lurid, inner margins ciliate; beneath, abdomen white-pubescent, legs lurid.

Length 0.18. Wings expand 0.35.

Description. HEAD oval, transverse, scarcely half the width of the thorax, with a ruffle of fine velvet-like hairs surrounding its base. *Antennæ* shorter than the thorax, moniliform, slightly and gradually diminished in diameter towards their tips; joints twenty in number in the males, each with a few very minute hairs directed forwards, in females sixteen, each verticillated with longer and coarser hairs. *Neck* in recent specimens chesnut-yellow, distinct and slightly elevating the head as though on a pedicel. *Thorax* broad-ovate, the length and breadth equal and the anterior part slightly narrower; two impressed longitudinal lines on the back, slightly converging posteriorly, and densely set with

minute hairs; intermediate space glabrous; sides with longer hairs most conspicuous and thickly set forward of the wings; posterior edge depressed into a deep impressed transverse line intervening between it and the scutel. ABDOMEN long-ovate, its broadest part nearly equalling the thorax, posterior edge of each segment marked by a lighter tinge; beneath chesnut-brown, thickly covered with short white hairs of a silky lustre; abdomen of females somewhat broader and shorter, terminated by a slightly exserted two-jointed ovipositor of a cinnamon-yellow color. LEGS glabrous, long and slender, hinder ones extending twenty-seven hundredths of an inch, of which the tarsi measure 0.13; blackish above, beneath light lurid brown; *femurs* slightly longer and conspicuously broader than the tibiæ, cylindric, somewhat contracted at their bases; *tibiæ* cylindric-clavate; *tarsi* black, first joint very short, third longest and most slender, fourth and fifth broadest. WINGS smoky-brown, translucent, broadest across the middle; nervures, except the anal, rectilinear; *mediastinal* confluent with the costal at the middle of the exterior margin; *postcostal* strongest, running direct to the tips of the wings; *medial* scarcely confluent with the inner margin at three-fourths the distance from base to tip, towards its base becoming a mere plait-like trace upon the wing, and at a first glance seeming to be a branch of the anal nervure; *anal* most developed towards its base, suddenly curved inwards and joining the inner margin near its middle, giving to the anal area a rhomboidal contour.

Larva. Pl. II. fig. 3. This is a small worm of a bright orange color, with the anterior extremity often red. It measures about twenty hundredths of an inch in length, and 0.08 in diameter, being of a cylindrical form, very slightly tapering towards, and obtusely rounded at both ends, more so at the posterior than the anterior extremity. A slightly projecting point is perceptible at the apex of the anterior end, and two similar projections at the opposite extremity. The larva is composed of but nine segments, each well marked by a contraction intervening at the joints. The anterior or head segment is the longest, and near the tip on its under side are two small, black lines, slightly diverging from each other as they proceed forwards; when closely examined under a magnifier, a dorsal row of deep pink-colored spots are seen of a square or trapezoidal form, one on each segment, reaching from its

anterior edge about a third of the distance across the segment. The stigmata or breathing pores, are also perceptible, and often a very slender pink-red line is seen reaching backwards from each pore across the segment, and a similar line running backwards from each of the dorsal spots. Traces of other lines of the same color are often visible upon the surface, sometimes branching and anastomosing with these, like blood vessels.

Pupa. Pl. II. fig. 2. The dimensions of the pupa do not perceptibly differ from those of the larva. The abdominal segments retain the same orange color which they possessed in the larva state, but the future head, thorax, and wings are sanguineous, red, and lustrous, as though wet with blood. The embryo legs reach far down upon the front, or under side of the abdomen, but are free, or not connected with it, as shown in the wriggling motions made by the pupa when removed from its cell. In short, the whole of the parts acquired by the change seem to be like a cap or helmet drawn over the head of the larva.

Galls. Pl. II. fig. 7. These are formed at the tips of the twigs of several willows that grow to the size of shrubs and small trees. They are of an oval or long-ovate form, from three-fourths of an inch to an inch and a half long, and nearly three-eighths of an inch in diameter at their broadest part. Externally, they are of a red, yellow, or greenish-brown color, being the same as that of the particular species of twig on which they grow. Some of the natural buds of the shrub often occur upon the surface of the gall, as bright and vigorous as those on the unaffected branches, and frequently one, two, or three twigs grow from its sides, appearing so well nourished and thrifty through the winter season, that we should scarcely deem they were destined to perish the coming summer, did not an inspection of the old galls, some of which may frequently be observed on the same shrubs, show their similar shoots almost invariably withered and decaying. About three-eighths of an inch of the upper end of the gall, is in all cases dry, brown, and brittle, curving to a point, and appearing like a kernel of ergot or spurred rye protruding from the gall, a well marked line of separation occurring at the junction of this dead with the lower living portion. Within, the substance of the gall is of a greenish white color, and a soft woody texture. A cylindrical canal, the tenth of an inch in diameter, runs from the base of the

gall, to the apex of the brittle horn at its summit, within which canal the larva lies. A beautiful provision of nature is here observable. The extreme tip of the horn at the top of the gall is so slender and brittle, that it is easily broken off by the slightest touch of the wing of a bird, or a contiguous twig agitated by the wind. It is therefore rare that it is found entire. But in breaking off, the edge of the part below, which thenceforth forms the apex of the horn, generally splits into several short, slender, elastic teeth or valves, the points of which converge so as to leave but a slight orifice into the canal below. The inclosed maggot, when ready to leave its cell, easily crowds these valves apart, and makes its exit—whilst any enemy attempting to insinuate itself into this orifice, only draws them more closely together. But that this curious structure sometimes fails of accomplishing the purpose for which it seems so admirably designed, will be rendered probable, when we come to speak of the enemies of this insect.

But little account is made in our country at the present day, of any of our several species of willow. That which in an economical point of view is probably the most valuable, is the species originally described by Muhlenberg, under the name of *rigida*. The very long, wand-like character possessed by the younger shoots, combined with the toughness and flexibility which is peculiar to them, have caused this to be esteemed more than any of our other native species, for the manufacture of baskets and other articles of willow-work. This, and its allied species *salix lucida*, (Muhl.,) seem to be the ones most preferred by the insect under consideration, though it also infests two or three others to a less extent. But upon our tall tree-willows it is never found—it may be, because their much more slender twigs would not afford sufficient nourishment for the insect, and the very slight articulations of these twigs would be incapable of sustaining the additional weight of these galls, without snapping off and falling to the ground with the first gust of wind. Of course those twigs of the *rigida* or American basket-willow, on which the galls are formed, become worthless for the use above alluded to. Their onward growth is arrested ere any of them attain that length which renders them valuable, and in the course of the following summer, most of them die entirely down to their origin.

Should it ever become an object to diminish the numbers of this

species, beyond what is accomplished by its natural enemies and destroyers, this might readily be effected, by selecting out the galls in the winter season, when they show conspicuously upon the leafless twigs, gathering them, and consigning them to the flames.

Habits.—From an inspection of the galls formed by the C. Salicis, it would seem that their growth is caused in the following mode. The parent deposits an egg at the tip of a twig of the willow, when it is growing vigorously, and is of a succulent texture. Probably this is in the month of June. The larva, on hatching, gradually eats its way downwards in the pith of the shoot, entirely consuming this as it advances, and thus forming the canal which runs longitudinally through the centre of the gall. This consumption of the pith causes the extreme and tenderest part of the twig where the young worm begins, to wither and die, forming the horn-like summit of the gall. The juices of the plant now flow to this part more copiously, either in consequence of the irritation produced by the worm, or (if we may consider this to have any analogy to what takes place in the animal economy under similar circumstances) an inflammation excited to produce a separation between the gangrened and living textures, or both these causes combined. The part hence receiving an unusual quantity of the nutritive fluids of the plant, becomes preternaturally developed into the fully formed gall, with its woody texture, forming a secure residence for the worm during the winter season which ensues. And often, one, two or three of the buds upon the sides of the gall are also stimulated into activity, and shoot forth, forming small branches implanted upon its walls.

At or near the bottom of the canal within the gall, the larva lies during the winter season, with its head upwards. The perfect insects are readily obtained at this time, by placing a few of these galls in a tumbler covered with paper and kept in a warm room. Thus situated, their metamorphoses are completed in eighteen or twenty days—scarcely one of them failing to produce a fly.

A thin, white, membraneous-like partition, is placed across the upper part of the canal within the gall, with its edges reflected downwards, and lining the inside of the cavity for a short distance; when ready to undergo its final change, the pupa, by a wriggling motion, crawls upwards, and rupturing this partition, ascends

through the horn-like summit of the gall, and almost entirely out of the cleft orifice at its apex. Thus exposed to the air, its superabundant fluids rapidly evaporate ; the parts within the outer film which envelops its body, contract and become more firm, and the fly gradually withdraws itself from the pupa skin, like a hand drawn from a tight glove, and floats forth upon the wing, leaving the blanched relicts of its pupa state adhering to the jagged teeth at the apex of the gall.

Enemies and Destroyers. Pl. II. fig. 8. Upon this topic, my investigations are as yet too limited to give but a few facts, leaving a more complete elucidation of it to a future occasion.

A larva quite different from C. Salicis, is occasionally found within the canal of these galls. It is of a dull pale greenish brown color, rather larger than the Cecidomyia maggot ; its body broadest anteriorly, moderately tapering towards the tail, and composed of thirteen segments ; the head is darker and polished ; the mandibles blackish, tinged with chestnut brown ; each of the three segments following, bears a pair of legs terminated by black feet. Viewed from above, it has a rugose or warty appearance, caused by a row of slightly elevated and darker colored spots on each side of the back, one being based upon the posterior edge of each segment. Lower down, on each side, is another similar row, the spots being upon the anterior edge of each segment. This worm is sometimes found in the upper part of the canal of the gall, with the larva of C. Salicis occupying its usual place in the lower part. But much oftener, at least in the latter part of winter, it is found in the lower part of the canal, the larva of the C. Salicis having disappeared. The presumption is hence strong, that this worm is carnivorous, devouring for its final meal, as it would seem, before it changes to its pupa state, the defenceless larva of the C. Salicis. What are its previous habits—on what it subsists to attain its present size, and how it obtains an entrance into the cell of the C. Salicis? are interesting inquiries, requiring a more extended series of observations than I have as yet been enabled to bestow. About one-tenth of the galls contain these larva.

But the Cecidomyia appears not always to die unavenged. I thrice observed the tenant of the willow gall to be a minute, glassy-white, footless grub, 0.08 long, and about a third as broad ; oval, minutely pubescent, composed of thirteen segments. These,

I conjectured, were infantile larva of the C. Salicis, until a fourth occurred apparently feeding upon a dead and considerably shrivelled larva of the kind just described. Hence the inference arises, that it may be some species of the Ichneumonidæ, that kills and subsists upon the Cecidomyia's destroyer.

A day since, on opening a withered and but half-grown gall, like some passed by before without examination, I discovered within its cavity, what appeared to be a dead and distorted larva of the C. Salicis, and as such, laid it beside other fragments to be cast into the fire. But happening to pass a magnifier over this, afterwards, it was shown to be a cluster of minute, oval, orange-colored pupa, some six or eight in number, each one seemingly formed within a separate segment of the larva's body. A tiny Ichneumon will probably prove to be the insect which thus lives parasitically within and eventually kills the larva of the C. Salicis.

Remarks.—The writer is not certain but the species of Cecidomyia now described, may prove to be identical with the *C. Salicina*, which infests the willows of France. Being able to refer to but a meagre description of that species, he is unable to determine this point decisively. That, however, is said to form its galls from the *buds* of the willow, and if this statement be correct, the species is, doubtless, distinct from the one above described.

Salem, N. Y., March 4, 1845.

All attempts to confine the blessings of religion, science, and liberty, have been visited by judgments. Every aristocracy has been broken down, and all attempts to enslave, have resulted in the ruin of the author. The only safe course which a community can follow is, to extend far and wide every privilege, and disseminate every where the elements of knowledge.

FARMERS' MISCELLANY.

ON THE PROPER TREATMENT AND MANAGEMENT OF MEADOW LAND.*

BY JESSE RYDER.

What I mean by meadow land, is that which, from the nature of the soil, is more natural to grass than grain, so much so, as to make it desirable to keep it all the time in grass. It also includes the light moist soil which is good for either grain or grass. As permanent meadow land, the same treatment applies to it all. And be it understood, I have reference to upland merely. To such land as, when poor, or the grass becomes thin upon it, is covered with a red moss, and frequently mouse-ear, being reduced to the production of bull's-eye, or white daisy, all of which are the effect, and not the cause of the absence of grass.

Those temporary meadows on dry land, which come of a rotation of crops, where the grass is renewed after tillage, and remains in but a short time, do not come within the purview of this article. The very dryness of the soil, which compels frequent ploughing, increases the profits of the farmer; his land is enriched by the easy and simple means of seed and plaster, in conjunction with the manure of the farm, and, as a general thing, such is the most profitable of all land.

But a far different system should be adopted with land which is too heavy and wet for grain, without manure.

From the nature of things, it requires manuring highly to insure a crop of grain, and the fertility of the soil cannot be maintained in tillage husbandry, by the cultivation of clover, as is that of dry land.

Where the soil of a farm is all of that nature, there should be no more ploughed than can be manured sufficiently to give good

* *Note by the Editors.*—The writer of the article above, in a private note accompanying it, says: "Had I possessed the information herein contained ten years ago, I should have been more than one thousand dollars better off than I now am."

assurance of every grain crop sought to be obtained therefrom. Consequently, that portion of the farm under tillage should be small in comparison with that of the same number of acres of dry land. But with the treatment which such land usually receives, the amount of manure made from the produce of the farm is too insignificant to maintain, much more to increase, its fertility. The common practice is to plough it up when the grass runs down, and take from it several meagre crops of grain, before it is again laid down to grass; then succeed two or three middling crops of grass, before it degenerates to the old standard, again inviting or compelling the owner to renew his impotent efforts to increase its fertility.

But such management is all wrong. The attempt to manage heavy land, the same as though it was dry, in order to renew the crop of grass upon it, necessarily involves frequent ploughing, with the application of little or no manure to the greater part of it, from the insufficiency of the supply; consequently, the land grows poorer and heavier by the operation. For soils which are naturally too stiff, but have been lightened by vegetable matter, speedily degenerate under tillage, and become less porous as the vegetable matter works out; leaving it compact, and heavy, and unfitting it for the growth of plants; so that it requires a very successful new seeding with grass, to again lighten it up and restore it to its former good estate. Such a system, then, should be adopted with such land, as will not diminish the amount of vegetable matter upon the surface of the soil. If it is desirable to plough the land, let it be up but one season as a summer fallow, and sown early with winter grain, and seeded with timothy in the fall, and clover in the spring; that enables the young grass to feed up the old, so that by the time the old roots are decomposed and appropriated to the use of the new crop, a more luxuriant growth is obtained, and the amount of vegetable matter in the soil increased; or, in other words, its fertility, or power of production is increased, which must be attributed to the large share of nourishment which plants derive from the atmosphere (being, according to Liebig, nine-tenths of the whole,) that makes the old roots a basis for nine times their weight of vegetable matter to be grown upon, or in the soil. This new estate can be maintained without manuring, as I shall show hereafter. Such, in my opinion, is the

extent to which land not fitted for a succession of grain crops may be ploughed.

But a far better way than ploughing exists, in my opinion, to renew the grass upon old meadow land. There are two ways in which it may be done without ploughing ; one through the agency of red clover, the other by top-dressing with manure, of which the one most important to be understood, because the easiest, and cheapest, is that which is effected by clover.

Strange as it may appear to some, clover is to stiff clayey soils when kept constantly in grass, and rightly managed, the same source of fertility that it is to dry land in a judicious rotation of crops.

Although it generally succeeds but poorly on such land in a new seeding, after tillage, owing to the roots being drawn out by frost, it by no means follows that such soils are incapable of producing it. On an old meadow matted with other grass, there is but little freezing and thawing of the surface to draw out the roots of clover, and the multiplicity of other grass roots tend to bind them to the soil.

But it requires peculiar management of meadow land to preserve in it a succession of clover so as to maintain the fertility of the soil, and renew other grass upon it, so as to increase its burthen, like to a new seeding.

By observation, I have been enabled to discover the circumstances which govern the production of clover on old meadows, which might be called an inductive theory of its operation. To secure its benefits, one general principle is to be observed, which is, to always let the rowen clover go to seed, before cattle are turned on to pasture the after crop.

The operation is simply : this suppose an old meadow that is running down to blue grass. Timothy and other grasses are dwindling to a light crop, and there are plants of clover scattered over the land, which are permitted to spring up after mowing, and go to seed. The seed sheds abroad over the surface in the fall and winter ; in the spring it comes up very early, and is protected from frosts by the old stubble and moss which is upon the land. The crop of other grass being light gives the young clover a chance to grow, which consequently brings the land round to clover, the old grass preserves the roots during the winter, the next year it is up betimes, and takes possession of the

ground by getting the start of other grass, provided the seeding was thick enough. If not, it seeds thicker the next fall, clover being on the increase, and thus it gets possession of the ground partially smothering other grass, and killing the moss. The land becomes completely renovated, but what becomes of the clover? The year it gets possession, there is naturally a great deal of seed grown in the fall, which scatters over the ground in great profusion; it comes up the next spring, but circumstances are now very different, there being a full growth of other grass, the young clover is nearly all smothered in turn. The old clover dies and the soil is further ameliorated by its roots, and timothy, red-top, and white clover take possession, in a rejuvenescent state, young clover is more or less killed until the timothy and red top dwindles again; and thus by proper management is clover made the agent of the farmer in fertilizing the soil, and increasing his crops, without the aid of manuring, or ploughing, vegetable matter accumulates on the surface, the soil becomes more open and friable and pervious to air, heat, and moisture, and this is all done for a soil that is naturally wet and heavy without manure. But these changes of grass are not periodical.

The shortest that can be made are once in three years a crop of clover, but they are generally irregular, owing to the vicissitudes of seasons, affecting the young clover for good or ill.

There are many who suppose it necessary to leave the second growth of grass undisturbed, to rot on the ground, in order to preserve the fertility and maintain the productiveness of old meadows in grass, where top-dressing with manure is not resorted to. But such management is not only unnecessary, but oftentimes extremely hurtful, and the injury is proportioned to the amount left untrodden and unfed. If the amount left standing, or laying loose upon the surface be considerable, it, in the first place, makes a harbor for mice, which will, under cover of the old grass, intersect the surface of the land with paths innumerable, from which they cut all the grass that comes in their way, more especially the crowns of the clover plants of which they seem especially fond.

In the second place, the loose covering of old grass seems to operate to shade and smother the young grass in the spring, that the young mice may have left, more especially the young timothy, and the result is that a meagre crop of what is here called spear

grass, or June grass, shoots up through the old grass as through a brush heap, in lieu of the good burthen of the year before.

I will here subjoin some general directions for the management of meadow land so as to secure a succession of clover, and consequently maintain the fertility of the soil.

1st. Always let the rowen clover go to seed.

2d. Always mow early, so that, if the season be dry, the clover may have a chance to get to seed. The hay will also weigh more and be of better quality.

3d. If the season be favorable and the second growth large, turn in upon it as soon as the clover seed begins to shed, in order that it may be sufficiently fed off and trampled down before winter, otherwise mow it the second time after sufficient seed has shed upon the ground.

4th. If the after-growth be light, so as if left upon the land, it will not endanger the next crop by shade and mice, do not pasture it at all.

Such treatment of meadow land is generous and good, and that generosity will be returned. It does not admit of turning cattle upon meadows as soon as they are mowed, to bite the grass down to the roots, killing some kinds and injuring others. Timothy grass, for instance, generally requires the balance of the season after mowing, in which to recruit, so as to put forth its best efforts the spring following.

The more kinds of grass there are growing on the same ground, the greater the weight produced, and the thicker the growth. Each kind is supposed to require some specific food, not appropriated by the others, therefore they can feed together without robbing each other, and therefore it is that old meadows can be made to produce much more weight of grass than those newly seeded.

White clover is an important grass on flourishing old meadows. It grows very thick at the bottom of the other grass, although in a good season it will grow to the height of from twelve to sixteen inches. It should be cut early or it will diminish fast, and in a dry season entirely disappear.

Red clover on old meadow will grow well when the ground is so wet as to hold water on its surface for two or three months in the spring. I have seen it in low spots completely covered for

-. Therefore land which produces abundant crops
-quire extensive draining for grain, and seeing
-land destroys its life it is far better to keep it

-n-dressing meadow land with manure,

- of culture, and manure can be
-ages over the clover culture,

-re uniform in amount by manuring
-fore it runs out to blue grass, which
-ange to clover—for, in the clover culture,
crops must be expected in a round of from

-ay is destined for market, clover is not as saleable
-ss, and it can be kept in a minority by pasturing the
-s close after mowing, and top-dressing with manure.

.. Heavier crops can be obtained by top-dressing than by any -ner system of management, the clover system seldom giving over two tons of hay to the acre, at one cutting—new seeding with timothy, three tons—when top-dressing gives three tons and upwards. Three and a half tons to the acre, obtained by top-dressing, will stand up as well as two tons of timothy newly seeded, being so much thicker at the bottom, and growing so many more kinds of grass. I have obtained three and a half tons to the acre in a good season, by spreading ten two-horse wagon loads of fresh livery stable manure to the acre, in February, on a stubble principally timothy the year before, when a portion of the meadow not dressed gave but two tons. I have spread fifteen loads of manure to the acre on poor, wet, heavy, meadow land, in the fall, where about half a ton of white daisy grew to the acre. The next year the crop was about one and a half tons of daisy and other grass, particularly red clover; the year following timothy began to get possession—crop about the same in weight. In the fall I put on about ten loads more to the acre, of swamp manure, that had laid one year in the hog pen; the result was full three and a half tons of hay to the acre of timothy, and some white daisy of equal height, and very tall. The next year there was a very heavy growth of timothy without daisy, which was now mastered and killed. Two

things I have ascertained by top-dressing, which may be useful for some farmers to know. One is, that it is the only way to exterminate from meadows daisies and weeds, and be paid for doing it, instead of paying for having it done.

Bull's-eye or white daisy, does not grow on my meadows, after the yield comes to exceed a ton and a half to the acre, except the year following the application of the manure—the growth being promoted for one year as much as that of other grass.

Another thing useful to know, is, that it pays better to manure good land than poor, when in grass ; the limit being where the effect is neutralized by the grass lodging early, and rotting at the bottom—at least, such is my experience.

As concerning the time in the year when manure should or ought to be applied to grass ground, it is, or must be varied by circumstances. But this much I will say, that it may be done as soon after mowing as is convenient, and not later than the first of March in this latitude.

If the land be naturally wet, so that in the spring months it is saturated with water, the manure should be applied as soon as possible after it is mowed. By so doing, the rain which falls in the dry part of the season soaks into the ground, and carries with it the strength of the manure, which is thus secured for the benefit of the land. If on such land it be put on in the winter, the spring rains float off a great part of its substance, and the effect is comparatively trifling.

I have seen as good effects from manuring in the summer, spots so wet that nothing but wild grass grew, as I have from manuring land that is esteemed dry enough ; it causes red-top to grow in such places most luxuriantly.

Another case where the manure should be applied early, is where the land is so poor that the grass is weak and thin. In such cases it should be applied immediately after mowing, so that the grass may have time to thicken up in the fall, for the year following. The greatest effect from the manure will then be observed in the first crop of grass. If it be put on late, the greatest effect will not be observed until the second crop is obtained. Early spreading is generally the best on any meadow land. I prefer unfermented stable manure, with the litter undecomposed, to the same manure in a rotten state ; and hot, dry weather, in summer, forms no ob-

jections in me to applying it immediately. In the dryest weather, the grass will soon spring up through the manure, when it will not grow at all on the parts adjacent.

The manure should be spread very evenly over the ground; if it be long manure, it should be shaken fine off the fork. There are but few hired men who are willing to perform the work aright.

I have used earth from the road-side, swamp manure, swamp manure with leached ashes spread on it after it was applied to the land, and leached ashes alone for top-dressing, of which the swamp manure and ashes together produced the greatest effect, being fully equal to stable manure, and will no doubt be much more lasting. The rich earth from the road-side, on the second year, more than four times paid for its application. Ashes alone show a decided good effect. The swamp manure alone has been on for two years without having effected much change—I suppose, because of its insoluble state, and the grass roots not having got hold of it—but I do not despair of its ultimate good effects. I think that, as a manure, it should always be applied to the surface, that it may be dissolved by the gases that float in the atmosphere, aided by the roots of the grass when they have taken possession of it. I know that it is extremely favorable to the growth of timothy when it is once appropriated to its use, and that the crop is maintained for a long time. Rich earth, from the sides of the fences, where it has been washed or ploughed in, would be excellent for top-dressing; never mind if the bushes are killed by it. In top-dressing with stable manure, I make it a point to sow plaster upon it as soon as I can after it is applied, and the more manure I put on the more plaster I sow, more being required to arrest the ammonia in its escape.

As I do not think that mowing without manuring necessarily impoverishes the land, and as I think that my meadows are rich enough, I shall hereafter depend on clover, and top-dressing with any substance that will lighten the surface soil, to kill the moss and renew the grass.

As an instance of the effect of clover, I will mention that I know a meadow which twenty years ago was a barren waste—the soil heavy, and the water, in the spring months, escaped from it by flowing over its surface—no grass grew upon it. It was summer

fallowed and sowed with rye, timothy, and clover seed ; a little manure was put on a part of it. It has never been manured since, except by plaster ; the hay from it has always been sold, and averages about two tons to the acre ; it is in clover about one quarter of the time, and is managed as I have directed in this article ; the soil is now very light, and the water soaks away freely.

When will farmers stop murdering their meadows, and keep more stock ? which they may do under a better system. Better soil the cattle with green corn, sown for that purpose, or clover, than to pasture so close.

EFFECTS OF MENTAL IMPRESSIONS DURING PREGNANCY.

I propose to enquire whether strong mental impressions made upon the mother, at particular times, will produce any effect upon her offspring.

This is not, as might appear at first sight, a question of curiosity alone, but is of practical value to every breeder of stock. If strong impressions made upon the female during heat, at the time of conception, or during pregnancy, are communicated to her young, it is highly important that those who wish to raise a pure breed, should at such seasons, prevent unfavorable impressions being made.

It is a fact well established in regard to the human female, that violent passions, or other strong mental impressions, may and often do cause the death and premature birth of the child. It is further argued and asserted by some, yet generally denied, that such impressions may also be communicated to the offspring during pregnancy, in such a manner, as to modify and even direct its organization. This opinion is founded upon a few, but well authenticated cases, in which there was an obvious recognized object, making a powerful impression of a disagreeable kind, complained of at the time, and followed by an effect in perfect correspondence with the previous cause. These facts are not denied, but are explained as coincidences; but in some of the in-

stances referred to and one of which is known to me personally, there is between the cause and effect, a similarity so perfect, that it is not easy to suppose it could have been accidental. Such are the views of men who have examined the subject as a matter of science, but among the uneducated, the belief is almost universal, that the imagination of the mother during pregnancy, has a strong controlling influence over her offspring. Indeed, the origin of this opinion is coeval with our earliest records, and although this alone should not be taken as proof, yet when we find a belief prevalent, not only in a single neighborhood, or even a single nation, but wide spread as the family of man, and this belief still further substantiated by occasional instances, occurring under our own observation, it requires a strong degree of skepticism to deny utterly its truth.

This influence is also claimed to operate upon the brute orders of creation, and although we cannot for a moment suppose animals to possess that same degree of sensitiveness as we claim for our own race, we cannot deny to them tender affections and sympathies, through which the causes here spoken of must operate.

No one circumstance connected with the history of the influence we are here discussing, has so effectually contributed to its permanency as a popular opinion, as the successful stratagem of Jacob to secure to himself the "ring streaked" cattle from the flocks of Laban. It is urged, however, that the effect here produced, was an indirect interposition of God in favor of Jacob, and against the crafty Laban. It would appear, however, from a careful consideration of the narrative, that Jacob only availed himself of knowledge, he had previously acquired as an experienced herdsman; yet, it is freely admitted that the *extent* of his success, was far greater than could have been anticipated from the influence of his motley rods alone. It is thus related. "And Jacob took him rods of green poplar, and of the hazel and chesnut tree; and pilled white streaks in them, and made the white appear which was in the rods. And he set the rods which he had pilled before the flocks in the gutters, in the watering troughs when the flocks came to drink, that they should conceive when they came to drink. And the flocks conceived before the rods,

and brought forth cattle ring-streaked, speckled and spotted."* Other instances of a similar description, are recorded by modern writers, clearly proving that the feelings of the mother *may* influence at least the color of her progeny. A striking case of the kind is given by Sir Everard Home.† An English mare, which had never been bred from before, was covered by a quagga,—a species of wild ass from Africa, which is marked somewhat like the Zebra. This happened in the year 1815, in the park of Earl Morton, in Scotland. The mare was only covered once, and the produce was a hybrid, marked like the father. The hybrid remained with the dam four months, when it was weaned and removed from her sight. She probably saw it again in the early part of 1816, but never afterwards. During the four years following, she had three foals by a black Arabian horse, (having missed once.) They were all marked more or less, like the quagga, and in two of them the resemblance in color, and in the hair of their manes, was very strong. They were distinguished by the dark line along the ridge of the back, the dark stripes across the forehead, and the dark bars across the back part of the legs. Mr. Mayo,‡ mentions that a similar instance was observed by Mr. Giles in a litter of pigs, which resembled in color, a former litter by a wild boar.

Similar facts are frequently observed, and many such are alluded to by modern writers. Mr. Milne,§ tells of a pregnant cat belonging to him, the end of whose tail was trodden on with so much violence, as to cause intense pain. She had five young ones perfect in every respect except the tail, which was in each of them, distorted near the end, and enlarged into a cartilaginous knob. Haller ‖ remarks, that the young foal of a horse, from a mare which, previously, had a mule by an ass, has something asinine in the form of its mouth and lips. Beecher¶ says, that when a mare has had a mule by an ass, and afterwards a foal by a horse, the foal bears evident marks of the mother having retained some ideas of her former paramour, the ass.

* Genesis. chap. xxx. verses 37-8-9.

† Philosoph. Transac. 1821. p. 21. and Lect. on Comp. Anat. vol. iii., p. 307.

‡ Outlines of Physiology, p. 376.

§ Transac. of Linnæn Soc., of London.

‖ Element. Physiol. viii., 104.

¶ Physic. Subterran. Lips., 1073.

The above cases related by Home, Haller, Beecher, and similar ones by others, are attempted to be explained on the principle, that the connexion with the male produces a physical impression, not merely upon the ova which are ripe for impregnation, but upon others which are at the time immature. This explanation will not apply, however, to the case of the cat, related by Milner, nor to the following. Mr. Boswell* says, "one of the most intelligent breeders I ever met with, in Scotland, Mr. Mustard, of Angus, told me that one of his cows chanced to come in season, while pasturing on a field which was bounded by that of one of his neighbors out of which an ox jumped, and went with the cow until she was brought home to the bull. The ox was white with black spots, and horned. Mr. Mustard had not a horned beast in his possession, nor one with any white on it. Nevertheless, the produce of the following spring was a black and white calf, with horns."

Now, if this be true, as above stated, and I am not aware that it has been denied, it shows that a strong impression made upon the imagination even of so dull a beast as a cow during heat, can produce an evident effect upon her calf. If careful observations were made it is highly probable similar results would be obtained frequently.

Mr. Blaine, as quoted by Walker,† relates two cases occurring in the dog tribe. He says, "I had a pug bitch, whose constant companion was a small and almost white spaniel dog, of Lord Rivers' breed, of which she was very fond. When it became necessary to separate her, on account of her oestrum, (*heat*,) from this dog, and to confine her with one of her own kind, she pined excessively; and notwithstanding her situation, it was some time before she would admit the attentions of the pug dog placed with her. At length, however, she did so; impregnation followed; and, at the usual period, she brought forth five pug puppies, one of which was elegantly white, and more slender than the others. The spaniel was soon afterwards given away, but the impression remained; for at two subsequent litters, (which were all she afterwards had,) she presented me with a white young one, which the fanciers know to be a very rare occurrence."

* Quarterly Journal of Agriculture, vol i., p. 28.
† Walker on intermarriage, p. 246-7.

"The late Dr. Hugh Smith used to relate a similar instance, which occurred to a favorite female setter that often followed his carriage. On one occasion, when travelling in the country, she became suddenly so enamoured of a mongrel that followed her, that, to separate them, he was forced, or rather, his anger irritated him, to shoot the mongrel, and he then proceeded on his journey. The image of this sudden favorite, however, still haunted the bitch, and for some weeks after, she pined excessively, and obstinately refused intimacy with any other dog. At length she accepted a well-bred setter; but when she whelped, the doctor was mortified with the sight of a litter which, he perceived, bore evident marks, particularly in color, of the favored cur, and they were accordingly destroyed. The same also, occurred in all her future puppings; invariably the breed was tainted by the lasting impression made by the mongrel."

Such, then, are a few of the facts, in relation to this matter, and they would seem to warrant the inference, that the maternal imagination may strongly mark her offspring. The time during which this effect may be produced is not so well established. It would appear, however, to take place during heat, or any early period of pregnancy. To apply this principle to a useful end, is well worthy of careful experiment. This could be done by any farmer, of sufficient knowledge, and possessed of moderate resources, without expense and with very little trouble. The nature of such experiments and the manner in which they should be conducted, will be suggested at once, to any intelligent, thinking mind.

Newburgh, March 1, 1845.

YELLOWS IN PEACH TREES.

BY A. SAUL.

The fatal malady termed "yellows" in peach trees, has of late aroused horticulturists to institute more than ordinary inquiry into the cause that produces it. In most of our Agricultural and Horticultural Journals, the subject has been discussed by men of experience and observation, and so puzzling is the subject, that scarcely two persons appear to come to the same conclusions, nor has any one individual, so far as I am aware of, satisfied himself that he has ascertained the cause of this disease. In the February number of the Cultivator is an article from Mr. Darling, of New Haven, Conn., placing before the readers of that journal what he calls, and what in my opinion is, a clear, unmistakable description of this fatal disease, with a view of awakening universal research, in the hope of finding some clue to the cause of this epidemic. And, although his positions, on the whole, so far as I am able to judge, are correct, I have never seen, in my comparatively limited opportunities of observation, sufficient to warrant me in agreeing with him in the conjecture he has hazarded, (to use his own words) that it is derived from some unknown insect. Nor do I think, as is generally supposed, we have evidence sufficient to justify the conclusion that the disease is contagious, and is communicated from tree to tree, while they are in blossom. The fact, that when the disease commences in a plantation containing a number of peach trees, it does not attack the whole at once, but breaks out in patches or parts of one or more trees, which are progressively enlarged in the next and ensuing years, till eventually all the trees become victims to the malady, is not of itself enough to settle this point; there must be something more detected in connection with these circumstances, to establish the theory that the disease is contagious.

Without attempting to prove that the debilitated state of trees having the yellows is caused by exhaustion, from excessively luxuriant and vigorous growth, and the consequently superabundant

crops that follow, there are many circumstances that I have noticed, that inclines my opinion in that direction. In England, where the peach tree is subjected to artificial management, rendered necessary by the humidity and deficiency of solar heat in that climate, to bring the fruit to perfection, either on walls or under glass, the "yellows" are not known. It is true, there are many insects, parasites, fungi, and other epidemics peculiar to this country, not known in Europe, and vice versa, that are very destructive to the cultivation of fruits and fruit trees. Consequently, this circumstance of itself is no proof. But the fact that in England, where peach trees are subjected to a regular routine of treatment, (of which I shall have a word or two to say in conclusion) the "yellows" are unknown, caused me in the first instance to look in that direction; and, although the instances afforded me for observation, and experiment, are but few, yet so far they bear out the theory which I have ventured to advance, that much of what is called yellows, is caused by exhaustion, and the entire neglect of a systematic routine of pruning, trimming the superabundant fruit crops, &c.

In 1839, there were among other fruit trees at this place (the establishment of A. J. Downing, & Co.) some old peach trees in bearing, part of which had the "yellows," and nearly all of which, (only two or three being left) have since disappeared, in the usual manner that trees do having the "yellows," or getting the disease from whatever cause. In the spring of that year, there were some young trees planted out, as standard trees, that have been pruned regularly every spring since; they have borne fine fruit for the last two years, the vigor of the trees at the same time being unimpaired, and show no symptoms of the yellows as yet. In the spring of 1840 and 1841, some trees were planted out for training in the manner of wall-trees, some of which were sorts known to be diseased, and consequently have since died; the others, that were of thrifty stock, have grown well, and have been pruned and trained in the usual manner as practised on wall-trees in Great Britain, &c. Some of them bore magnificent fruit last season, and are in a most luxuriant and healthy state. Again, peach trees with *entire* leaves, which are sorts not subject to mildew, are generally the greatest bearers, and generally most affected by the "yellows;" while, on the contrary, peach trees with serrated leaves

are generally the more moderate bearers, and are the sorts mostly affected with mildew, and seldom with the yellows. There may be a few exceptions, but this is generally the rule. The inference to be drawn from this is, in the case of serrated leaved, mildewed varieties, the shoots affected with mildew perish as far down as diseased, and answer, to a certain extent, the purpose of pruning, and generally these sorts have very dark green foliage, and seldom have the "yellows;" whereas, on the contrary, the entire leaved varieties, not being subject to mildew, ripen their shoots to the very extremities, and bear fruit to the same extent when not pruned; the consequence is, the complete exhaustion of the vital powers of the tree in the production and maturing of such immense crops of fruit, so frequently seen on young and vigorous trees for the first year or two after they commence bearing.

It is well known that peach trees raised from healthy stock, grow very thrifty for the first four or five years, or, until they first bear fruit, and seldom or ever show symptoms of the yellows until they have borne fruit, unless taken from diseased stock. Consequently, the first and second crops are generally of fair quality and immense quantity, and it has never been matter of surprise to me, to see trees allowed to grow and produce in this manner, show signs, if not of the "yellows," of a state of exhaustion equally bad; for in nineteen cases out of twenty, trees are treated, or rather allowed to maltreat themselves as above described. Now, I ask, is it not as reasonable to look to the cause of the debility manifested in peach trees that have what is termed the "yellows," in the exhausted state of trees above mentioned, as to the disease being communicated from tree to tree while in blossom, as supposed by many? The fact of healthy trees seldom or ever showing any symptoms of the malady before they blossom, has given rise to the idea of its being communicated while in blossom; but it will be borne in mind that trees *rarely* bear fruit before they blossom, and seldom show signs of the disease until the fruit is half grown, or more, and the symptoms become more evident as they approach maturity, and at no time previous is it so visible as at that stage when the tree is ripening its fruit, when the whole resources of the tree are called into action to perform the important offices required at that eventful period.

Mr. Darling cites an instance of buds being taken from a tree

in fruit, (I suppose before the fruit was ripe) which grew and made vigorous trees, while the old tree, after ripening its fruit, showed the yellows. This would appear to bear out the opinion that the disease is caused at the time of ripening its fruit more than at the period of the tree being in blossom, for it is well known that buds taken from trees having the yellows, if inserted in stocks ever so healthy, the disease will manifest itself in the tree produced by the bud, for in the vegetable as well as the animal kingdom there is a limit set, beyond which disease, when neglected, becomes incurable, and when such stock is propagated from, no matter whether from seed, buds, or any other way, the parent will entail on its offspring its constitutional infirmities.

I promised to say a word on the subject of pruning, in conclusion. The length of this communication already, will necessarily compel me to be more brief than the subject demands. On trees which bear on the last year's wood, *like the peach*, there is a necessity for annually shortening the branches, in order to provide a supply of new shoots for bearing the next season. The proper time for this operation depends a great deal upon the season, but as a general rule, about the middle or end of March is soon enough, and in late seasons, the beginning of April, or any time before the blossom expands, and trees of very vigorous growth may even be pruned in full blossom, as to cut the wood late in the spring is one of the remedies for excessive luxuriance. Weak trees should be cut as soon as the buds show the first symptoms of swelling in the spring.

In pruning the peach tree, the first thing to be attended to, is to cut out all weak and superfluous branches, such as are inclined to cross each other, and those that are wiry and sapless, and in old trees, thinning out decayed branches, and worn out bearers, and retain all the best shoots, selecting those that are *short-jointed* and *most fertile*, rejecting alike the over luxuriant, with the weak and sapless. Those retained, should stand at such distances as to allow the foliage and young shoots plenty of room to grow without crowding each other, then shorten those branches from half to a fourth, according to their strength, always bearing in mind to prune the luxuriant branches or trees least, and the weaker ones most. Were the strong tree much cut, it would produce shoots so disproportionately large, as are alike bad for wood and fruit,

while the weak tree, unless relieved by pruning short, would not long continue to bear at all. A great deal may be done during the summer in the way of pruning, disbudding ill-placed and superfluous branches, wood buds, &c. Indeed were this part properly attended to, there would be little left for spring pruning, except shortening the branches. But when there is so little attention paid to spring pruning, it is hardly to be expected that summer management will be attended to.

Trimming the fruit is another operation that claims more attention than is paid to it. When the trees have set their fruit very thick, they should be partially thinned, as soon as they are fairly set, reserving the final thinning until the fruit is done stoning; that is, till the shell is quite hard, and the kernel formed—for most trees drop some of their fruit in the time of stoning, especially those anywise unhealthy, so that the thinning had better be performed at two or three different times, always observing to retain the fullest, brownest, and best formed fruit. With respect to the quantity or number of fruit proper to be left on the tree, much must depend on the size of the fruit, and vigor of the tree, large varieties requiring to be thinned more than small varieties of fruits; full grown healthy trees, too, being allowed to bear more than young and feeble trees, &c. The mistaken idea, than which nothing can be more absurd, entertained by many, of losing so much of their fruit, in carrying out the above directions, I know is the great obstacle to their adoption. Any person having peach trees about bearing the coming season, may convince himself by comparison. If they have two trees of a kind, both healthy, and as near as possible alike in size, and all other respects, let the one be treated according to the above directions, and let the other produce as it has been wont to do. It will be found that the tree treated in the above manner will produce an equal, and if the system be moderately carried out, a greater weight of fruit, and these much finer and of higher flavor, consequently worth a great deal more; while, at the same time, the tree is preserved in a healthy and vigorous state, and I think, prevent much of what is called the "yellows."

HIGHLAND HORTICULTURAL NURSERIES, *Newburgh, March 10th*, 1845.

IMPROVEMENT OF STOCK.

It is highly important that more attention should be given by the agricultural community generally, to the improvement of stock. Now and then, among our native cattle, an animal may be found of more than ordinary good qualities. But as a general thing, we are poorly off in this respect. It is a fact that astonished us not a little, when we first made the discovery, that the farmers, in some of the best parts of this country for dairying, sell off their cows every fall to avoid the expense of wintering them, and buy a new stock in the spring. Now if their cattle, were such as they ought to be, they would not do this.

We do not profess to understand thoroughly the principles of breeding. But we are inclined to believe that almost every farmer knows enough of them, to improve his breed of cattle very much. The best and most improved breeds of the present day, have all been produced from the common native cattle, by judicious management. And if farmers would supply themselves with good stock, they would not be willing to put them away every fall.

We think the agricultural societies are at some fault in this matter. Their attention has been too much directed to imported breeds, and thus our native breed has been neglected. Out of a large number of premiums offered at the last fair of the New-York State Agricultural Society, a very small number only, were offered for native cattle. Under such circumstances, there is no inducement to do any thing, except what the individual enterprise of any man may prompt him to. And such enterprise is not very abundant in this country. We cover such an extent of surface, and embrace such varieties of climate, that we cannot expect the breeders of Britain to supply us with animals suited to all parts. We must do something ourselves.

But since so much dependence is placed upon imported cattle, it becomes a matter of some importance to determine the best for particular climate or soils in this country. We do not comprehend the differences existing between the different breeds, and have no preferences founded on fancy or prejudice, and of course

can say nothing by way of recommendation. But whenever we hit upon any thing, which appears to us worthy of notice, on this subject, we shall lay it before our readers, that they may be aided in forming a judgment. It is with this in view, that we make the following extracts, from English papers. The first is from a speech of a celebrated breeder, W. Fisher Hobbs, Esq., before the East Essex Agricultural Society.

"When he first became a farmer, he was determined to have a good breed of cattle. He first tried Short-Horns, because he thought they were the *best*; and at a sale in Suffolk, he purchased several, better than which could not be obtained. He also purchased some Herefords, and kept them together for twelve months, and the result was most decidedly in favor of the Herefords. He was therefore compelled, *contrary to his own wishes*, to give up the Short-Horns and take to Herefords; and he had from that time continued to do so, being satisfied that with his soil and climate, they paid the best. (*Hear, hear.*) He trusted the farmers whom he was addressing, would do as he had done, and judge for themselves what description of stock was best suited to their farms; and when they were satisfied that they had a breed which would prove *most profitable* to them, he would advise them to *keep to them*; and if they came here to exhibit them and were occasionally unsuccessful, he would advise them to go home, with a determination of meeting with more success on a future occasion."

The following is from the "Hereford Times."

"IMPORTANT TO DAIRYMEN—HEREFORDS AND SHORT-HORNS."

"A gentleman in Leicestershire, who keeps a large dairy of Short-Horn cows, wishing to make a comparison between them and the Herefords, bought a Hereford cow at the Rev'd J. R. Smythie's sale in 1839. He soon found that the Hereford gave less milk than many of his Short-Horns, but, as she was a fine looking cow, and a good breeder, he continued to use her in his dairy. In the spring of 1843, he determined upon making a more exact comparison as to the quantity and quality of the milk given by the respective breeds. For this purpose a short-horned cow was selected of the same age, and which calved within two days of the same time as the Hereford. The milk of each, was carefully

measured; the Short-Horn was found to give *nine* and the Hereford *six* quarts at a *meal*. The milk was set up and churned separately; that from the Hereford produced *nine* pounds, and the Short-Horn not quite *five* pounds of butter per week. They stood in the same stall—were fed on the same description of food, and had been kept alike previous to calving. It has also been proved that two quarts of milk from a Hereford, will produce as much *curd* as three from a Short-Horn cow. The gentleman is now crossing his Short-Horn cows with a Hereford bull, with a view of improving the quality of his milk."

POTATOES.—EXPERIMENTS.

During the coming season judicious experiments ought to be made with the potatoe, to ascertain, if possible, more of the disease which has made such ravages in it for the last two years, and also the best mode of curing or preventing it. And to do this, let every farmer bestow particular attention upon all the circumstances connected with planting and cultivating them, such as the following:—whether they are most affected in old tilled land, or that which has been lying still in fallow or in grass for some years—whether in manured land or that which has not been manured—whether one kind of manure seems to be better for them than another—the effect of saline substances as nitrate of soda, saltpetre, lime, plaster, ashes—whether they succeed best in shaded land or that which is exposed to the sun—in dry or moist land—and the peculiarity of the soils in which they are most and least diseased.

We can conceive that great practical good may result from such observations, if generally and carefully made. The date upon which the disease is first observed should be noticed—the temperature of the air for a few days about that time, and the temperature of the earth, both on the surface, and about four inches beneath it. Such observations are attended, it is true, with some extra trouble, but if they are followed up systematically, the trouble will not be thrown away. Let every thing be noted down on

paper at the time it is observed, and forwarded to us when the crop is lifted, and we will make up the result. It would be well for young farmers to form the habit of making such observations.

We would also suggest the making of some careful experiments on the general cultivation of this crop. It is not by any means a settled point whether they should be planted whole, in pieces, or whether the eyes or buds are not as good as either. As far as our experience goes—and we have made a number of careful experiments—we think there is no difference. But we think tubers of a good size are better than small ones. We may state one fact.

In the spring of 1844, we received from a friend one potatoe, just brought from Antwerp. It contained eight buds. The tuber was carefully divided, so as to include one bud in each piece, and each one planted in a separate hill. In the summer, before earthing them up, a shovel full of stable manure was thrown on each hill, and covered. The produce of the eight hills was 110 potatoes of good size—or nearly half a bushel. At the same time, we had a crop from whole potatoes, and another from mere eyes, and we could see no difference in the quantity or size of the produce. If it be a fact, that there is no difference, in a winter of scarcity, the seed end of the tuber may be cut off and preserved for planting, and the rest eaten.

The history of this useful plant is somewhat curious. It is doubtless a native of this continent. Its original locality seems to have been, as far as can be ascertained, in the mountainous regions of South America, near Quito. From that country they were introduced into Spain, early in the sixteenth century. From Spain it appears to have spread slowly through the southern parts of Europe, and in the latter part of that century reached Germany. About this time it was brought into Britain.

Sir Walter Raleigh first planted it on his estate near Cork, in Ireland, whence it was soon carried over into England. They were considered rather as a delicacy than an article of common food—and as to potatoe eaters, it is certainly amusing to read such accounts as are given by Parkinson, that "the tubers were sometimes roasted and steeped in *sack and sugar*, or baked with marrow and spices, and even preserved and candied by the comfit-makers."

It was a century and a half however, before they became gene-

rally known and cultivated in that island, since which time they have become a general article of food.

The numerous varieties of the potatoe which we have at the present day, have been produced from seed. The method of doing this, is as follows: The balls or apples, are gathered when the vines begin to die in the fall. They must be broken and the seed washed out, or pressed out through a sieve, and separated from the pulp and dried. In the spring, they may be planted in drills, and carefully cultivated through the summer. In the fall, each vine will be found to have a few small tubers attached to it. These may be separated, those belonging to each vine being kept by themselves, to be planted the next spring. At the end of the second season some will have attained sufficient size, to try their quality. But out of the whole quantity there may not be one of good character enough to preserve. If there should be any, they can be selected, and the others thrown away.

SELECTION OF SEED.

If much depends, in order to secure a good crop, upon the ploughing and manuring and after tillage, much likewise depends upon the kind of seed. Every one is not probably aware that new varieties in the vegetable kingdom are produced by *crossing*, just as they are among animals. If two kinds of plants of the same general family, be grown near each other till they produce seed, their seed will probably be "mixed" as it is called, and neither will produce the same kind of plant again. This is often seen in Indian corn, or in peas raised in the same garden—in cultivated fruit, and various plants. When, therefore, a good variety is grown, great care should be taken that no poor kind is grown near it, lest it should degenerate. The most of garden vegetables have become mixed in this way, so that it is difficult to find pure seed now. We think that farmers would do well to devote a portion of land every year, separate from his main crops, to the raising of seed for the next year. The extra cultivation he might bestow upon it,

would do much to improve the seed. In saving seed, that which is the most prolific, and which ripens earliest, should be chosen. By this means much may be gained.

Mr. Loudon states that in the spring of 1823, he selected a wheat plant, from near the centre of a field, which produced sixty-three ears, and yielded two thousand seven hundred and forty-three grains. These he planted, and the fourth harvest brought him three hundred and twenty bushels of sound grain. Any farmer, in this way, from one seed of a good kind, could in a few years raise enough to sow his whole farm. The same author in this connection, makes the following statement, showing the advantage of choosing the most prolific seed :

"The number of fertile joints in the spike of the wheat generally cultivated, varies from eighteen to twenty, and the inhabitants of Great Britain and Ireland amount to about the same number of millions ; therefore, as the wheat produced in those islands has been of late years sufficient, or nearly sufficient, to supply the inhabitants thereof with bread, it is evident that a variety with two additional fertile joints, and equal in other respects to the varieties at present in cultivation, would, when it became an object of general culture, afford a supply of bread to feed two millions of souls without even another acre being brought under cultivation, or an additional drop of sweat from the brow of the husbandman." *Encyclopedia of Agriculture, Art.* 4861.

DEGENERACY FROM BAD TILLAGE.

The evils of bad cultivation do not consist in bad crops alone. There are other and still greater evils to be avoided, and which should be a great inducement to every farmer, to use any effort to perfect himself in his art. And not the least of them is degeneracy in the character of the plant cultivated. In this respect, if in no other, there is a sort of analogy between the animal and the vegetable. An animal of any of the best and most improved breeds, if badly cared for when young—if scantily or insufficiently supplied with food, and exposed to all kinds of weather, and left

to its own chances of support, will grow up a scurvy, ill-shaped, unsightly thing; and one or two generations will bring it back to even a worse creature than its most distant sire.

Just so it is with the plant. High cultivation has produced all our valuable plants. Some of them, at least, have sprung from an apparently worthless vegetable, but by proper care and culture, they have been made the necessary dependence of man. But let them be left to the starving, slovenly methods of poor farmers, and it is impossible to tell how soon they may be utterly lost. They must be fed—they must be kept free from thieving weeds that rob them of their food—they must have all circumstances made the most favorable, in order to retain their present state. The constant tending is to degenerate. We have some drawings of plants which show this tendency in a remarkable degree. We hope at some future time, to lay them before our readers.

The effort of the farmer should be not only to raise the greatest quantity to the acre, but to make that quantity at the same time the most valuable for the purposes for which it is intended.

GARDENING.

A good garden is an essential part of the comfort of a family, and is generally too much neglected by the farmer. He would find himself largely repaid if he would pay more attention to this branch of his business, and set apart a small portion of land for the cultivation of those vegetables which require more attention than the ordinary farm crops. And in villages, every one who can obtain it, has a high estimate of his garden spot. The relaxation it affords, for a few moments in the day, to the professional man—the exercise before breakfast, and after the business of the day is over—the luxury of vegetables, fresh from the ground, and the fruit of his own labor, are all considerations of no little consequence. The cultivation of the soil, even in a small way, is an improvement to the body and the mind, and a man whose heart is

seared over by the constant toil and the *pecuniary* affairs of life, feels it grow green and young again, when he turns back to this employment. As the season approaches to commence gardening, we venture a few hints in relation to it.

Do not be sparing in the application of manures. You may have as handsome and good a spot for your garden as you can select, but unless it is well manured you will have nothing handsome or good in it, nor profitable. Unless vegetables are well supplied with food they will amount to nothing. The manure should be well rotted, so as to break up fine and incorporate easily with the soil. Poudrette or guano, if judiciously used, will be found peculiarly fitted for the garden. But if stable manure is used, it should be spread evenly over the surface, and then the ground spaded deep and well pulverised. No matter what you intend to plant, this is a point of great importance. It serves to give a free circulation of air about the roots of plants, and also, if the season should be dry, in a considerable degree prevents the effects of drought, by allowing the moisture to ascend from below. The roots of the plants, too, can extend easier and farther in a loose soil, than in a heavy one, and the more room they have, the better will be the growth of the plant. If the soil is not naturally deep, it should be dug from twelve to eighteen inches deep and be made very rich with manure, which process will soon produce a soil of sufficient depth. We advise the use of the spade in all cases, even where ploughing might be done. It goes deeper, divides the earth more perfectly, and mixes the manure more uniformly with it, and the extra expense will be more than repaid in increased products. Where the soil is principally clay, it will be materially benefited by applying a few loads of sand. This, put on before the ground is dug, will make it much more loose and easier to cultivate. If sand predominates, clay may be added. Heavy soils will also be improved by having the manure mixed with twice its bulk of peat or swamp muck, and lie in a pile two or three weeks before it is used. The quantity of manure would be increased by that, and the soil made light and warm.

Throughout the season the garden should be kept free from weeds. Not one should be suffered to live. They rob the plants of much nourishment. The soil should be frequently stirred about the roots of plants, but never immediately after rain. Do not

throw weeds away, but dig a small pit in the corner and there deposit them, with the scrapings of the walks and the soapsuds and waste liquids from the house. In this way a considerable quantity of valuable manure may be saved for the next year.

All these remarks apply no less to the flower garden—a most delightful addition to the comforts and taste of any—even the humblest residence. There is no difference in the preparation of the soil—and when this is ready we should be glad to see more of our ladies engaged in the active labor of taking care of its future success. The exercise might serve to transfer some of the bloom of the flowers to cheeks that have been blanched and paled by too much housing. Neither plants nor ladies thrive well shut up in a close room, away from the free air and the light of the blessed sun. If we were young—as we used to be—we would discourse more at large on this latter topic, but we have reached that age when it "don't do" for us to say much about "love among the roses."

AGRICULTURAL STUDY.

Before agriculture in this country, reaches the degree of perfection which it has already attained in other countries, our farmers must devote themselves more to the study of their art. This, we believe, they have begun, very extensively, to feel. The disposition has heretofore been, to demand from writers on the subject, nothing but what was purely practical—not in the true sense of the word—but in a false sense—that is, they must have the very processes described to them which others have used, and then with the whole actual result before their eyes, they could venture upon a trial of them themselves. Had this been the case with all who are engaged in the business—had there been none more willing than others to take the first step, agriculture would have been at an amazing low ebb. But some who have been bold enough to think for themselves, have taken the lead, and to this we owe the present condition of farming. But these means are, in our view, and we believe, in the view of all thinking men, utterly inadequate to the present demand. A more general information is necessary. Farmers must read and study and think for themselves. There is no practice in the whole range of agriculture whose fuundation is not laid in reason. Farming is not, in its foundation, practical,

as that term is generally understood, but it is, in the first place, a science which the mind must comprehend, before the hand can execute it.

FRUIT TREES.

Instead of continuing the old practice of having alternate bearing and barren years, for fruit trees, those who cultivate them would do well to note this fact: When young trees come into bearing for the first time, about the time the fruit is setting, if the most of it is taken off, and this continued for a few years in succession leaving every year about the same quantity on the trees, they will, by the time they have become of sufficient size to be profitable, acquire the habit of bearing every year.

A FRAGMENT.

We may estimate the worth and truth of any system of philosophy by the value which that system places upon life; or we may estimate it by another standard, and may ask what are its tendencies; if its tendency is to exalt God, the maker and ruler of the universe, then *a priori*, we should say of that philosophy, that it is true. Again, if the tendency of a system is also such that it promotes the happiness of man, its truth may also be considered as at least probable. If the life of man, if the interests of man, if the interests and happiness of man is valued in it, and promoted by it, we can scarcely be justified in charging upon such a philosophy a foundation in error. Inquire then, within yourself, what effect a system of philosophy or creed has upon your views of God, of the happiness of man, whether it has lessened or whether it tends to lessen him in your estimation and make you reckless of life and happiness? then we believe, by this test, you may render an answer both as to its value and its truth.

PRACTICAL DIRECTIONS FOR THE FLOWER GARDEN.

PART I.

BY H. SUTTER.

I HAVE never been ashamed to confess that I love flowers. They are the Poetry of Agriculture, and I thank God that He made them, and implanted in my heart the love for them.

I have been accustomed, all my life—even when I was a man of study, as well as since—to devote a portion of my time, in the season, to the culture of flowers. I have found it a delightful occupation, and of great use to my heart, if not to my purse. And I always feel a sort of pity, when I see flowers made a traffic of, unless I buy them myself, and turn them out in the open garden, for every body to admire. For it seems to me that they are, and should be, nobody's property. I never kept them to sell, but always to give to my friends and to little children, in abundance.

I am gratified to see a growing taste throughout the community, for this branch of agriculture. Almost every lady has her beautiful exotics in her window, and the poorest cottager has her geranium or her monthly rose; yet, through the winter, there are always to be seen some who seem to be waiting with great patience for better times. The cultivators of them are ignorant of the care they ought to have, and how to manage them. For such persons, the following pages may be of use.

The farmer neglects this branch of his art too much. There is no earthly reason why his garden should not be ornamented with flowers; but the fact is, he is too utilitarian in his notions. We hope his daughters will read these articles and profit by them; I did not write them because I was ambitious of being an author, and especially in this department. They are the fruits of my own experience and reading, and were written down in this form at the earnest request of a respected friend and his lady, for their use. But being entirely practical, I thought they might be of use, if printed, to others.

I.—OF THE SOIL.

All soil is formed of decayed rocks, and its fertility, of course, largely depends upon the particular rock from which it has its origin. But one great source of fertility is the vegetable and animal

substances which are constantly accumulating and undergoing decomposition, upon or beneath the surface. These form a part of all soils, and none will be productive which contains less than two parts in a hundred of these matters; and on the other hand, a soil cannot be in a proper condition, to produce healthy plants, which contains too much of them. Those soils which contain from three to ten per cent of them, are the best. To those which are deficient, they may be added, in the form of the various manures which are used.

The soil for a flower garden is in no respect different from that of the kitchen garden, and should be prepared in the same manner. If the soil is too stiff and clayey, a few loads of sand may be added, according to the size of the garden; and if, on the contrary, it contains too much sand already, a proper quantity of clay or good stiff loam mixed with it, will soon bring it to a proper consistency.

After these preliminaries have been properly attended to, the ground should be spaded deep, and well pulverized; this will serve to make the earth open and light, so that the roots will meet with no obstruction, and it will also allow the free circulation of the air through it, which is very necessary for the health of plants. The deeper it is worked, the deeper will the roots strike, and, of course, the better will be the growth of the plant. This will also serve to prevent, in a considerable degree, the effects of drought, by giving a free chance for the water to rise from beneath.

The texture of the soil is not a matter of small importance. It should be such as will retain a proper quantity of water, and at the same time will drain off that which is superfluous. It should not contain so much clay as to bake in the sun and to crack open, nor so much sand as to become parched and dry. The power of retaining moisture depends upon the proportion of clay the soil contains, as the water cannot, even by great heat, be entirely expelled from this substance. But if there is too much, it will become hard and crack, and the roots cannot penetrate it freely.

Artificial soils are made for plants growing in pots, by a mixture of different substances, in order to imitate, as nearly as possible, the natural soil in which they grow. This is the plan generally pursued by gardeners and florists; but it is doubtful, in most cases, if any necessity requires it. If a loose soil from the garden, with a little addition of sand be used, and well mixed with

fine manure, it will be found the most convenient, and probably as good for plants. A little wood ashes may also be used. The artificial soils are made by mixing loam, peat, decayed leaves—forming what is called leaf mould—sand, and manure.

Loam is the mixture of clay and sand, constituting the soil of a garden, or old pastures, and should be taken from the surface, or just beneath the sod.

Peat is formed in low ground, by the decay of leaves, roots and stems of plants which have grown upon the spot for centuries.

Leaf mould is taken from the surface of the ground or rocks in forests, and should form an important part in the soil.

Sand should be taken from some place where it has had long a free exposure to the air.

Manure should be two or three years old, and well rotted, so as to be easily reduced to fine particles.

These substances, mixed in proper proportions, will form a soil suitable for any plants. Some naturally grow in a soil more sandy than others—some in a soil principally or wholly of loam, and others of mould; and in these we have the means of suiting the native habits of each. They should be well pulverized, and intimately mixed, and always ready for use.

It is often convenient to combine the flower garden with the kitchen garden. In such a case, the best arrangement that can be made, is to lay out a broad walk through the most convenient part, and on each side of it a border about three feet wide for flowers. This may be slightly raised by shovelling the earth which is taken from the walks into these borders. Others may, if necessary, be made around the sides or in the middle, by devoting a sufficient space for the purpose, which can be laid out according to the fancy or taste of any one. By having the two combined, a neatness and grace is added to the utility of the kitchen garden, and both can be taken care of together. No particular directions can be given as to the form and plan of such a garden. Much will depend upon the size of it, and more upon the taste of the one who takes care of it.

II.—OF MANURES.

Let the soil of the garden be what it may, and let it possess all other natural advantages, without the free application of manures, the labor bestowed will meet with a very small return. If these are necessary in the kitchen garden to insure a good growth of vegetables raised there, they are no less important in the flower-

garden. It is from them that plants derive their food, and they live by food as well as animals. Many seem to have an idea that if plants are freely supplied with water, they have all that is necessary to promote their growth; but this is a great mistake. Water is essential to the life of plants, but at the same time there are very few which will not die soon if they had no other food. Indeed, this can scarcely be considered as food, being principally necessary to dissolve those substances which are their proper nutriment. It is only in this form that they can imbibe nourishment, and too free a supply of water becomes injurious to the life of vegetables. Hence the necessity of draining land which does not admit an easy passage off for the water.

The dung of animals must always be the chief dependence in the article of manures. This consists of both animal and vegetable matter, and contains all the elements of plants. To prepare it for use in the flower garden, it should be well rotted by lying in heaps for two or three years, so as to be reduced to fine particles. In this way it will incorporate readily with the soil, and many of its parts will dissolve in water easily, and afford a rapid supply of food. Good manure from the stable-yard, well rotted, is as good as any that can be used.

Poudrette is a manufactured manure, possessing very powerful qualities, and would probably be found very valuable in the flower garden. It is prepared for this purpose, and put up in boxes so as to be easily transported. It may be applied to the whole surface of the soil, and then incorporated with the rake, or, which is probably the preferable mode, it may be applied to the roots of the individual plants. A small quantity placed upon the seeds when they are sown, is said to cause them to germinate with great vigor. *Guano*, imported from tropical islands, is a most powerful manure, and requires much care in using. A very small quantity is sufficient for a whole flower garden. It may be conveniently used by dissolving it in water, and applying it around the roots of plants twice a year.

Much valuable manure may be saved by collecting all the weeds, leaves, twigs, and dead plants, &c., which are taken away from the garden, and forming a small compost heap with them. To do this, whenever a quantity of these materials is added to the heap, they should be covered with a layer of earth, or stable manure, which is better, and so by adding to the quantity continually, in

the course of the season a large pile will be formed. A vast deal is wasted by not being economical in what appear to be small things.

Too much cannot be said in favor of liquid manures. In all countries where gardening is carried to any perfection, this practice is found to be of great service. The manure is thus applied directly to the roots, and in a state to be immediately taken up by the roots. It throws a surprising degree of vigor into them. The Chinese, who are celebrated for their skill in horticulture, apply their manures principally in this form. It is only necessary to pour water upon any of the common manures in a convenient vessel, and after it has stood for a day or two, dip it off, and water the plants with it, taking care to apply it only to the roots. Soap-suds will be found a very powerful and useful manure of this sort, and may be used freely.

Charcoal, wood ashes, and soot, have very valuable qualities as manures, and should not be neglected. The first should be reduced to a fine powder before it is used, and the last should only be applied in small quantities. The ashes may be used freely upon all soils with great advantage.

Plants will thrive well and vigorously in finely powdered charcoal, and it has been thought to add beauty and depth of color, both to the foliage and flowers. Cuttings of plants will rot sooner in pure charcoal, or when it is largely mixed with earth, than in earth alone ; but it must constantly be kept wet. It will be found a useful application to soils in all cases ; applied about the roots of diseased plants, the most beneficial results have been obtained.

The manure in a flower garden, should not be spaded in very deep. After the ground has been well dug and pulverized, let the manure be applied, and worked in to a moderate depth with a spade, and well mixed with the soil. Or a portion may be turned in deep, and the rest well mixed with the surface.

In speaking of manures, those salts should not be omitted which have of late excited no little attention. Many of them act as powerful stimulants to the growth of plants, and others are useful as actually affording nutriment. Among these, the most important are saltpetre and the nitrate of soda. They may be sown broadcast upon the surface, to be dissolved and washed down with the rain, or they may be dissolved in water at the rate of one ounce to

a gallon of water, and then applied as other liquid manures. Great caution is however necessary in the use of these substances, as too much of them will destroy the life of plants. They should not be applied more than once or twice during the season. The principal benefit from their use, is found in their producing a rapid growth, and giving a fine rich color to the foliage.

The free use of manures cannot be too strongly urged. All success in the cultivation of flowers, as well as all kinds of plants and vegetables, will depend upon this. Neither animal nor vegetable life can be sustained without food. And the flowers which ornament the garden, are no less dependent on it for the exhibition of their beauty, than those plants which are grown for use, for their perfection.

III.—OF THE CARE OF THE FLOWER GARDEN.

No little care is necessary in order to keep the flower garden neat and clean. The walks should be kept free from weeds and grass, and covered with gravel not very coarse, and if possible should be made solid with a heavy roller. A handful of coarse salt applied to any tufts of grass which may be seen springing up, will soon destroy them. If the walks are through a grass-plat, the edges should be kept cut evenly with a sharp spade, as also the edges of the flower borders.

Not a weed should be suffered to appear among the flowers, and as soon as one appears, it should be immediately exterminated by the roots. In this way, by a little watchfulness and attention, in a short time they will cease to appear. But if one is suffered to go to seed, it will scatter its offspring through the whole garden in a little while.

The earths in the borders and about the roots of the plants should be frequently stirred with a hoe or a gardener's trowel, that the roots may have every chance to extend. The looser the soil is kept, the better they will grow, and the beauty and perfection of the flowers depend upon the strength and healthiness of the plant. By this process also, the soil is drained of superfluous moisture, and a free circulation of air is produced about the roots. It should be done very often, and especially in dry weather, and not after a shower or rain.

All dead branches should be cut off carefully from the plants

with a sharp knife, and not rudely torn off, as is the practice with some careless persons. When any annual plant has done flowering, unless it is wanted for seed, it should be removed and another put in its place. For this purpose, a reserve bed may be kept in some part of the garden, where plants can be raised to be transplanted to supply vacancies in the regular borders.

Decayed flowers should be taken off, as they are unsightly objects in a neat border, and the stems of bulbous plants and others should be cut down when the flowers have gone. Plants which grow tall and slender, should be carefully tied up to neat stakes to support them, and the shrubbery neatly pruned.

A spade, shovel, large and small hoe and trowel are always necessary in the flower garden, and should be always ready for use. Pine sticks, cut smooth, and pointed at one end, should be always in readiness for marking the names of plants, and also neat rods for tying up plants. Bass matting makes the best strings.

IV.—PROPAGATION.

The natural way of propagating all plants is by seed. Under favorable circumstances, these are always produced by all plants, but a change of climate and soil often prevents it, when we must resort to artificial methods.

In selecting seeds, great care should be taken to choose those which have not lost the power of germination, by being kept too long, or by being exposed to unfavorable circumstances. Some retain this power for an indefinite period. Wheat, which was taken from the covering of an Egyptian mummy, and which had lain for thousands of years, was found to have retained this power, and germinated and ripened its seed when planted. Others lose it after a few years, and some even in a few weeks. As a general rule, the seeds of the last season only can be relied on with safety.

Seeds should not be gathered till they are perfectly ripe; very few seeds will germinate unless they are mature.

With regard to the depth at which seeds should be planted, no particular directions can be given. This will depend in a great degree upon the size of the seed and its ability to force its way through the ground. Small ones require but a small covering of earth, and should be planted thick, whilst large ones may be buried

deeper and more scattered. As a general rule, no seed should be planted deeper than one half inch below the surface.

Seeds should not be sown in the open ground till it has become warm and the weather settled. As almost all annual plants may be expected to bloom in from eight to ten weeks after they are sown, there is no reason for inordinate haste in getting them into the ground. From the first to the middle of May in this climate, will be soon enough. They may be sown in drills or patches, so that when they come up they can easily be distinguished from the weeds. When large enough they can be thinned out, and those that will bear it can be transplanted. Those which will not bear it, must, of course, be left in the spot where they grew. As a general thing, except in cases of severe drought, no artificial watering should be given to seeds, but they should be left to the natural moisture of the ground. Many, however, may be soaked with advantage in warm water before they are sown.

The process of transplanting should be performed with care, as the plant depends upon its roots for its supply of nourishment, and especially the tender fibres which form their extremities, and are their proper mouths. If any of these are injured or broken off, it will take some time to recover from it, or the plant may die. It is, of course, a bad plan to pull up the plant by force. It should be carefully raised up by a trowel or sharpened stick and taken with as much earth as possible attached to the roots, and removed to the place where it is to be deposited, and there placed in as natural a manner as possible, and the earth pressed gently around it. A little water may be given to settle the earth about the roots. Transplanting should be done in cloudy weather and the plants protected for a few days from the direct rays of the sun.

As some plants do not ripen seed, and others do not reproduce their own kind, artificial methods have been devised for propagating them. This may be done in several ways.

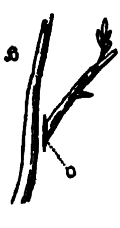
1. By gums, bulbs or offsets. Some plants, such as the lily tribe, the capen and bignonia, produce in the axil of the leaf, a small conical bulb or gum, which, if planted, will take root and grow. Bulbous roots throw out offsets from their sides: these, whether growing from the stem or root, should be planted as soon

as they are separated from the main plant, about their own depth in a good soil.

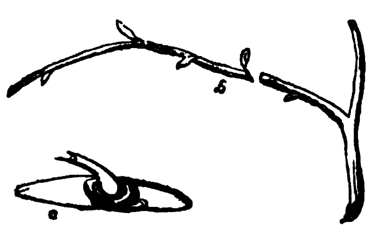
2. By dividing the plant. It is taken out of the ground, all the earth shaken from the roots, and then separated in such a way that a portion of root may be left to each part. Some may be divided without removing from the ground, with a sharp spade or the trowel.

3. By runners. These are slender shoots that spring out from the roots of some plants, and wherever a joint comes in contact with the earth a root is produced. All that is necessary is to let the joint become well rooted before it is removed. Similar to these are the suckers which start out just above the roots of some plants, and send down roots into the soil.

4. By cuttings or slips. These are only small portions of the branch, which are removed and planted separately, and inasmuch as the propagation of a great many of our most ornamental plants depends upon this mode, it may be well to give more minute directions with regard to it. Many annuals which do not ripen their seed, are thus continued from year to year, and form some of the chief ornaments of our flower gardens. Such are the beautiful varieties of the verbena and pelunia, salvia splendens, and many others, which enliven our borders through the whole season. In this way also, varieties of flowering plants are perpetuated, the seed of which will not reproduce the same kinds, monthly roses and most plants which are grown in pots.



Slips should be taken from wood of the latest growth which has become hardened, and where it is possible, with a collar of the old wood, (fig. *a*.) If not, they should be cut off with a sharp knife, making a smooth surface immediately below a leaf bud and as close as possible to the foot of the leaf, (fig. *b*.) The length of the cutting is of little consequence, but it may consist of three or four joints or buds, and the leaves near the upper end may be left on. But great care should be taken to make a smooth cut, as, if the bark is torn or jagged, it will most certainly fail. Some plants



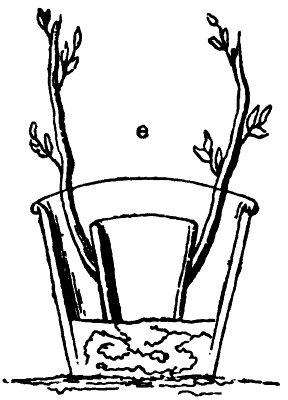
may be produced from cuttings, taken off without reference to the bud. But this is the surest way. Sometimes a mere bud taken off with a portion of bark attached to it, will take root, (fig. *c*.)

Cuttings of some plants will root freely if merely placed at a proper depth in any good soil, but on the other hand, the greater number require more or less care, and some are made to root with great difficulty. Such can only be grown to advantage in a green-house. Many require the artificial heat of a hot-bed, in which the pots must be sunk; and indeed all will root sooner in this way. But they should be removed as soon as they are well established in their growth, to the open air.

The best soil for cuttings is a tolerably rich one, with a free mixture of white sand, to prevent its becoming packed and hard, and to assist in draining it. A large proportion of powdered charcoal will be found of great service. Indeed, it will be found that in pure charcoal kept constantly wet, cuttings will grow more sure than in any other way, sometimes becoming rooted in a few days. Cuttings of some plants root better in pure sand. Fill a pot within an inch and a half of the top with earth, and on this place an inch of sand. Through this sink the cutting, till the end just touches the earth.

The pots in which cuttings are planted should be well drained, so as to carry off all superfluous moisture. For this purpose, a piece of broken pot should be placed over the hole in the bottom and a layer of the same upon it. On the top of this the earth should be put, to within a half inch of the top. In this the slips are to be planted, either in the centre, or which is better, at the sides, so that they will touch the inner surface of the pot throughout the whole length. This being porous will retain moisture, and part with it slowly, so that there is little danger of drowning them.

The following is an excellent plan: in the bottom of a large pot place a layer of broken tiles, so deep that a small pot set upon them in the middle, will be level at the top with the large one. The bottom hole of the inner one is to be stopped tight with a cork. Having placed them thus, fill the space around with good soil in which the slips are to be planted, with their ends cut slant-

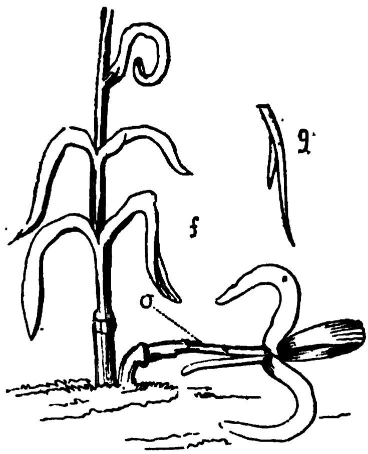


ing so as to fit against the side of the small pot, (fig. *e.*) This is to be kept full of water which will pass through its pores in sufficient quantities, so that none need be given to the earth itself. The pots themselves, must of course, be unglazed.

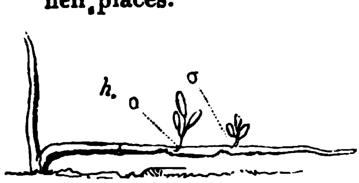
To preserve a uniform moisture, and to prevent excessive evaporation, a large tumbler or bell-glass, is of use, placed over the cuttings and pressed gently into the ground around them. This should be occasionally taken off, to allow a supply of fresh air to enter. They should be kept free from the direct light and heat of the sun, but where they can have a good supply of light. Sinking the pots in the ground will be useful in order to secure a uniform moisture of the earth in them.

No cutting should be planted deep, though large ones may be deeper than small ones. If they are sunk down to the second bud it will generally be deep enough. About midsummer is the best time for planting cuttings, as the wood is then usually ripe. As soon as they have rooted well, they should be transplanted singly into pots, or the places where they are to remain.

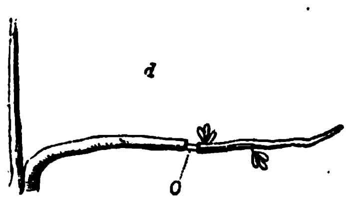
5. By layers. This consists simply in turning down a branch, fastening it with a hooked stick, and covering it with earth. The advantage in this method is that the layer has the benefit of a connection with a parent plant till it has become rooted. Some plants will send out roots if a joint happens to be upon or near the surface of the moist ground. There are several modes of layering plants, of which the following are the most convenient:



With a sharp knife make an incision half way through the branch to be layered, at or just below the bud or joint. Then, turning the edge, of the knife upwards, towards the top, split it through the bud a short distance, say half an inch or more. At this point then, it is to be buried under the ground, the end being placed as nearly as possible upright, so as to keep the split open. They must be fastened down with a hooked stick, to prevent their being disturbed before they have taken root. After this has taken place, they should be carefully separated from the old plant, and in a few days removed heir, places.



Another mode is to take out a notch just below a bud, as deep as the centre of the branch, which is then to be treated as above. Where a whole branch is layered, if the notch is made at each bud, a num- number of plants may be obtained.



Ringing, or taking off a small ring of the bark, quite around it, and down to the wood, is another method. This must be done also just below a bud or joint. The Chinese grow a great many dwarf fruit trees in this way. They select the fruit bearing branches, and ringing them, bind on the ring a ball of rich earth, which is kept constantly wet by water dropping from a vessel placed above. They become rooted in a few weeks, when they are removed to pots. The orange and lemon may be propagated in this way with success; or the branch may be thrust through a hole in the bottom

of a pot, which can be filled with earth, and kept wet in the same way; or, instead of ringing, a few holes pierced through the branch with an awl, will answer as well.

6. In arching—another method of propagating some kinds of flowering plants, consists in uniting two branches whilst attached to the parent stem. But as this cannot be practised generally, except under the most favorable circumstances, it will be passed by.

7. Budding is a process which can be performed by any one, and thus much beauty may be added to the flower garden. This is done by making an incision about one quarter of an inch in length, across the branch and through the bark. Perpendicular to this, another incision is made downwards, an inch or more in length, also through the bark. The bud is prepared by taking it from the last year's growth of wood, which has become hard, with about an inch, or even less, of the bark below, and a half an inch above it, cutting it off smooth down to the wood, or even with a small piece of wood attached to it, which may afterwards be carefully removed, or left at pleasure. Now, with a flat piece of ivory, like a narrow paper-folder, loosen the bark on both sides of the incision that was made, and carefully insert the bud, pressing it down till the bark attached to it is nearly all in, and then cut off the upper end of this bark even with the transverse incision. Tie the bark down moderately tight with a soft woolen yarn, both above and below the bud, passing it several times around. The bass matting used by florists is still better than yarn. But this is mentioned as being easily procured. In three or four weeks the bud will have taken, when the string must be removed.

Budding may be performed from July to September, and in the following spring the stem should be cut off close above the bud.

8. New varieties of flowers are produced by impregnating the flower of one plant with the pollen or dust of another of the same family. All that is necessary, is to to cut off, with a sharp pointed scissors the stamens of the plant to be operated on, and with a fine camel's hair pencil take the dust from the one with which it is to be impregnated, and deposit it on the pistil of the former. This is to be done in general, shortly after the flower opens. After the seed ripens, it is to be sown as usual. In this way the endless varieties of flowers which adorn our gardens, are produced.

MANURE.—NO. II.

MANAGEMENT AND APPLICATION.

It has appeared to us better, before examining the causes influencing the action of manures, to make our remarks assume a more practical form, and direct the attention of our readers to the management and application of those substances which are commonly used for supplying the food of plants. These are points which—let objectors say what they may—are capable of being, to a great degree, settled. Experiment, if correctly pursued, will be found to confirm whatever theory suggests. And in advocating economical farming, it is necessary to have a good understanding of the way in which manures may be made to exert their utmost effect and suffer the least loss. But we do not theorise only—we depend upon what is already known from experience in some measure, and shall attempt, in as brief a manner as possible, to lay the matter in a clear light before the reader. If in doing this, we say much that some already know, we are certain they will excuse us, when they reflect that we write for the ignorant, that they also may know.

The first consideration then, claiming our notice, is the *saving of manure*. We read in ancient mythology, of the Ægean stables, and their purification; but we realize something of it, when we see the mountains of manure which the Wolga bears away every spring, on its ice—the accumulations of the neighboring farm-yards —or when, "on the borders of the Roman Campagna, we see whole hills of dung—the long accumulating refuse from the stables of the post-house." Such an exhibition might excite surprise in the most slovenly and wasteful of our farmers; and yet, among the best of our practical agriculturists, instances are not rare, of a disregard of saving, which, if not exactly parallel to these, are, to say the least, equally deplorable. We have ourselves travelled through a large portion of our new states, and witnessed much of this evil. Vast piles of manure are suffered to go to waste, or even carted out in the spring and thrown into some pond-hole—the entire straw of numerous harvests left to rot on the spot where it was threshed, or turned on the same spot, are some of the evi-

dences of ignorance and sloth, which have often met our eyes. In those new settlements, men do not seem to look forward beyond the present fertility of the soil—to its slow, indeed, but certain, deterioration; and we can regard such practices there, with some pardon. But when we find the same disposition manifested—though not so palpably, perhaps—in the old, and already worn-out sections of the country—the little care that is taken to increase the quantity and improve the quality of manures—in suffering the whole drainage of the farm-yard to run off into some stream or pond, and such like waste, we cannot suppress the expression of our surprise. It would often seem, indeed, as if the dung hill were placed intentionally where every thing should be most favorable to secure for it the most thorough washing, from the rains falling upon it, and all atmospheric aid in becoming completely dissipated. Let us employ, then, a short space in investigating the resources of the farm for its own maintenance.

1. The farm-yard ought to be the mine of wealth to every one who appreciates the value of manure. Here are collected the excrements of all the domestic animals—the litter of the stalls—the straw and refuse of the farm, and all those substances which have once constituted a plant, and are, of course, the very materials necessary to supply food to others. We will consider, hereafter, the means of preserving these manures, and bringing them to that condition in which they will most efficaciously promote vegetation. We wish, now, to impress upon the minds of every tiller of the soil, the great importance of collecting in one spot, every thing which will in the least degree promote the growth of a plant, or the maturity of a seed. Its construction should be such, that no particle shall ever escape from it, and capacity so great as to hold all that can be accumulated in it. And the main source of waste is generally found in the passage that is allowed for the liquids to flow off. This should be prevented by the construction of tanks which will receive it; and from these it should often be pumped out and distributed on the solid contents of the yard. There, also, should be collected the liquid excrements of animals—a species of manure which is ordinarily little regarded, or entirely wasted, but which is, in fact, far more powerful in its action than the solid. It is in the attention which the farmer bestows upon this subject, that his enterprise and intelligence appears, and

a good opinion may commonly be formed of the man, by the condition of his farm-yard. Those countries which have excelled in agriculture, have always been those which have used the greatest diligence in the collection of every thing which could act as a manure.

2. Aside from the farm-yard may be found much that, rightly managed, will add greatly to the fertility of the soil; but all ought to be gathered in there. The contents of the piggery—of the poultry-house—night soil—the waste of the house, and all the weeds of the farm, if added to the general stock, would swell the amount considerably. Thoroughly scientific farming, may suggest the application of particular manures to certain crops; but the amount of knowledge we now have on this subject, and the method of farming in this country, preclude this for the present. We must be content to supply food to different plants, from the common stock of manure, till we understand more of the particular wants of each.

We may mention, in this connection, the vast bodies of marl and of peat, which exist in every neighborhood, and on almost every farm. In these is to be found a source of fertility almost inexhaustible; and yet it is wonderful how few are aware of their value. We stated, in a previous article, the composition of plants, and from that it will be evident, that whatever has once helped to constitute the body of a plant when living, is capable, after death, of being resolved again into that form in which it may be again taken up by a new plant, in the shape of food. All animal bodies are derived from the same source, and are capable of the same change. Whatever, therefore, on the farm, has ever been once a component part of a plant or an animal, should be carefully preserved and prepared, to be applied to the soil, to increase its fertility. The annual waste of these substances, in every neighborhood, is enormous, and indeed, upon every farm that is not conducted upon principles of economy. We are led, then, directly to the consideration of the preparation and management of the manure on the farm.

The idea has been advanced in years past by writers, in speaking of the distinction between plants and animals, that one point of difference is to be found in the form in which they receive their food. Animals require food of a highly organized form,

which by the powers of the alimentary canal, is converted into nutriment for their bodies. On the other hand, plants require their food in quite an opposite condition—that is, in order to fit it for their use, it must be decomposed and reduced almost to its elementary state. In our former article, we partially dissented from this opinion, and expressed the idea that they as well as animals, have the power of converting organic matter into nutriment, after they have absorbed it. One thing is, however, beyond dispute—that all their nutriment which they receive by their roots, must be in a fluid form, and all substances must be reduced to a soluble state, before they are fit for absorption by them. It will be the object of the farmer then to convert all his manures into this state. But at the same time, let it be remembered, that during the changes which take place in animal and vegetable matter, while passing into this condition, it is liable to experience a great waste, which is to be carefully guarded against. What this waste consists in, will readily appear upon referring to the constitution of plants. During the process of fermentation which takes place in most manure, those elements called organic, enter into various combinations, which being very volatile, are borne into the air and mingle with it, to be distributed far and wide over the earth. Those parts which are fixed and not volatile, if in a soluble state, are liable to be washed out by the rain falling upon them, and in these two ways alone, a manure heap may speedily be converted into an almost useless mass. Again—if the fermentation goes on too rapidly, and without proper precaution, it will soon have gone through a process equivalent to, and in fact the same as combustion, and little else will remain except a heap of ash.

We do not hesitate boldly to dissent from the theory, that manures may be too much decomposed for beneficial application to the soil. But let it be remembered that the decomposition must be carefully conducted, and under such circumstances as to secure against waste of any of the useful matter. We have long entertained this opinion, and are confirmed in it by experience. The experiments of Mr. Campbell of Scotland, of soaking seeds in solutions of salts, adds great weight to our position. The full growth and vigor of a plant is very much affected by the vigor of germination, and the plentiful supply of nutriment, at an early

period of its life. It is thus enabled to send out numerous roots into the soil, and to expand its leaves rapidly to the light and air, and prepare itself to thrive at a period when food is less abundant. Precisely such will be the effect of thoroughly decomposed manures. But when applied in their raw state—that is, without fermentation—depending upon adventitious causes to promote those changes which they must undergo—at one time furnishing an abundant supply, and at another scarcely any—and exercising their least influence at the period of germination, and directly afterwards, when the young plant requires all possible nourishment and aid to establish its vital powers—they cannot be supposed to produce as strong an effect as in the other case. It is indeed a generally admitted fact, that manures do not have so much effect the first year, as the year following that in which they are applied. If we were to reason by analogy, from the animal race, the position will be farther substantiated. We cannot deny, that where the common imprudent attention to, and reckless disregard of the principles upon which manures act, is followed out in the utter neglect of all care to secure them against injury or waste, the unfermented state is the best. For when once in the ground, they are safe from so much loss. The mere practical farmer would therefore do well to apply his manures in their fresh state, and plough them in—the rational farmer will prepare them beforehand, so as to secure their greatest effect. And we shall conclude this paper with a few practical directions for the care and management of farm-yard manure.

We have stated already that all kinds should be collected in the yard. By this means a mixture is obtained, promising in a degree the qualities of all, and proper to be applied to any crop. The yard should be made sloping from the sides to the centre, so as to prevent any liquid from escaping, and the bottom should be covered with a thick layer of peat, or swamp muck, or vegetable matter—or, in the want of any of these, a quantity of earth may be used. In the lowest part a tank should be sunk, capable of containing many hogsheads of water, and into which all the drainings of the yard should be conducted. During the season in which cattle and horses are stabled, all the manure and litter must be removed from the stables and spread over the surface of the yard, to be trodden down and mixed with the substances already placed

there. Thus a compost is formed, which by the addition daily of new materials, is partially excluded from the air, and by the treading of cattle is so condensed, that the decomposition which ensues is slow and gradual, and equal through the whole mass. The gases which would otherwise escape, are arrested by the peat, or earth, which was added, and the salts are taken up by the water which passes through, and carried with all other soluble substances to the tank. From this the liquid should be frequently pumped out, and distributed over the contents of the yard. To this same tank the liquids from the stables should be led, to be used in the same way. Under such treatment, the whole mass will be speedily reduced to a fine and powerful manure, and the smell of ammonia, so often discovered about the dung-heap will be entirely wanting, and the presence of that substance will not be indicated in the adjacent atmosphere by the most powerful tests. The use of charcoal, gypsum, and other salts, has been often recommended for the purpose of arresting the ammonia generated in manure heaps. If conducted as recommended above, they may be dispensed with for this purpose, although they would be valuable additions to the manure. In fact, all substances which are capable of furnishing food for vegetables should be gathered into this place as the storehouse of the farmer's hopes.

The formation of compost heaps, we regard as still better than the above. In this case the management for the foundation of the heaps should be the same as that recommended for the yard, and also for the preservation of the liquids, both from the manure and from the stables. Every fresh addition to the heap should be spread on evenly, and not thrown upon it carelessly, for the object is to promote an equal and uniform decomposition. To secure this also, and to prevent a rise of temperature, and consequently too rapid fermentation, the heaps should be made quite solid. This may be effected by the feet of the workmen who construct it, by rolling, or by driving the teams over it as the fresh portions of manure are added. As the heap increases in height, which should never be more than three or four feet, every few inches a layer of peat or earth may be made, which will be found highly useful in absorbing the gases which may be found, and thus these substances will be converted into manure as good as the rest. The liquid from the tank should be frequently distributed over the

heap to keep it from becoming too dry. All the substances which would be added to the mass of the manure in the farm-yard may be in the same way added to the compost heap to increase the quantity as well as improve the value of it.

We had proposed to defer the consideration of the application of manures to the soil, to a future article. We will, however, venture one or two remarks on that subject here. Are not manures too generally buried too deep for obtaining their full influence upon growing plants? There are two sources of loss to be avoided—one is the tendency of the gases to escape into the air, and the other the tendency of the soluble portions to be washed downwards into the earth; and these in practice stand directly opposite to each other. But, we believe, the downward tendency is the most to be avoided. A very slight covering of earth, from its porous nature, is capable of confining all the gases. But the rain falling upon the earth and passing directly through the soil, must inevitably, in its passage, carry down too low for the roots of plants, all the soluble portions of manure. Allowance must be made for difference in soils; we refer to the general principle, which will be examined more at large hereafter.

NEW BOOKS.

LECTURES ON AGRICULTURAL CHEMISTRY AND GEOLOGY. "The profit of the earth is for all; the King himself is served by the yield."—Eccles, v. 9. By JAMES F. W. JOHNSTON, M. A., F. R. S. S., L. & E., etc. With an Appendix. Republished by Wiley & Putnam. 619 pp., besides the Appendix of 89 p. Price, 12s.

THE American publishers of this work have performed an exceedingly important service to the American farmer, by giving these lectures of Prof. Johnston in a compact and cheap form—for cheap they are, considering the amount of matter which they contain, and the great interest of the subjects which are discussed in them.

There is only occasionally a work so opportune as this; one which the times required, and without which, a blank would have been very obvious to every intelligent agriculturist. We have, in fact, very rarely studied a work which came up to so high a standard of excellence as this, and which of itself forms what may be truly styled "*the Farmer's Text Book.*" The lectures are plain and simple, yet full, and though the subjects themselves would excuse the use of many technical terms, yet there are none of which the farmer can complain.

The author has divided them into four parts, taking up and treating the subjects in the order of their simplicity. He commences with the elementary principles which belong to the subjects, and proceeds to those which are more complex, and farther removed from the common attainments of gentlemen who have not made chemistry and its kindred sciences special subjects of cultivation. By this disposition of the matters treated of, those obscurities are really avoided which may seem to exist, when the more advanced part of the course is reached, and are taken up without reference to what has preceded, or what has been already explained. The reader will see from the following brief synopsis

of the subjects treated of, the whole range and scope of the lectures as they were delivered.

"The first part is devoted to the *organic elements* and parts of plants, the nature and sources of those elements, and to an explanation of the mode in which they become converted into the substance of plants; the second to the *inorganic elements* of plants, comprehending the study of the soils from which these elements are derived, and the general relations of geology to agriculture; the third to the various methods, mechanical and chemical, by which the soil may be improved, and especially to the *nature of manures* by which soils are made more productive; and the fourth to the *results of vegetation*, to the kind and value of the food produced under different circumstances, and its relation to the growth and feeding of cattle, and to the amount and quality of dairy produce."

It will be perceived that this synopsis of subjects covers a wide range of matter; in fact, the whole field of domestic economy. That the reader may have some idea how the distinguished lecturer handles his subjects, we give one extract at random.

"WHY LIME MUST BE KEPT NEAR THE SURFACE.—Nor will you fail to see the important reasons why lime ought to be kept near the surface of the soil—since

1st. The action of lime on organic matter is almost nothing in the absence of air and moisture. If the lime sink, therefore, beyond the constant reach of fresh air, its efficacy is in a great degree lost.

2d. But the agency of the light and heat of the sun, though I have not hitherto specially insisted upon their action, are scarcely less necessary to the full experience of the benefits which lime is capable of conferring. The light of the sun accelerates nearly all the chemical decompositions that take place in the soil—while some it appears especially to promote. The warmth of the sun's rays may penetrate to some depth, but the light can only act upon the immediate surface of the soil. Hence the skilful agriculturist will endeavor, if possible, to keep some of his lime at least upon the very surface of his arable land. Perhaps this influence of light might be even adduced as an argument in favor of the frequent application of lime in small doses, as a means of keeping a portion of it always within reach of the sun's rays; and this more especially on grass lands, to which no mechanical means can be applied for the purpose of bringing again to the surface the lime that has sunk.

There are, at the same time, as you will recollect, good reasons, also, why a portion of the lime should be diffused through the soil, both for the purpose of combining with organic acids already existing there, and with a view of acting upon certain inorganic or mineral substances, which are either decidedly injurious, or by the action of lime may be rendered more wholesome to vegetation.

In order that this diffusion may be effected, and especially that lime may not be unnecessarily wasted where pains are taken by mechanical means to keep it near the surface, an efficient system of underdrainage should be carefully kept up. Where rains that fall are allowed to flow off the surface of the land, they wash more lime away the more carefully it is kept among the upper soil—but where a free outlet is afforded to the waters beneath, they carry the lime with them as they sink towards the subsoil, and have been robbed again of the greater part of it before they escape into the drains. Thus, on drained land, the rains that fall aid lime in producing its beneficial effects, while in undrained land they in a greater or less degree counteract it."

CHEMISTRY AS EXEMPLIFYING THE WISDOM AND BENEFICENCE OF GOD: By George Fownes, P. H. D. New-York, Wiley & Putnam. Philadelphia, J. W. Moore. 1844, pp. 158, 12mo. Price 50 cents.

THIS work is a Prize Essay, prepared by the author in fulfilment of an appointment by the President, Managers and Members of the Royal Institution of Great Britain, a committee, charged with the execution of a bequest of £1000, the interest of which is to be devoted septennially as a prize for the best essay, illustrative of the wisdom and benificence of the Almighty.* The subject selected for the first essay is announced in the title page as above.

The range and foundation of the argument demonstrating the goodness and benevolence of God, as illustrated in the chemistry of organic and inorganic substances, may be seen in the special subjects of the essay. The order in which they stand is as follows:

1. The Chemical History of the Earth and the atmosphere.

2. The peculiarities which characterize organic substances generally.

3. The composition and sustenance of Plants.

4. The relations existing between plants and animals.

The critical notices of this work have been uniformly kind and flattering to its author, both as to value of its matter and the clearness of the argument and the simplicity of its style.

For an illustration of its character, we give the following quotation from the 106–7 pp., almost at random, on the cause and source of animal heat:

"Carbon and hydrogen are burned in the blood, and this to an extent which will strike with surprise, and at first, incredulity, those unaccustomed to such considerations. Many ounces of carbon are, in every individual, daily rejected from the lungs as carbonic acid. It is impossible that combustible matter can thus be disposed of without the evolution of a vast amount of heat; as much heat, in fact, as if it had been burnt in a fire grate.

This heat is manifest in the elevation of temperature which the animal frame always possesses above that of the surrounding medium; an elevation of temperature always in the direct proportion to the amount of nervous and muscular energy of the animal, and the vigor of respiration, but never in any single case altogether absent.

The internal capillary combustion is the source of animal heat.

Thus much for the body. Every part where blood-vessels are to be found; every part, where nervous influence is perceptible; every organ, every tissue; muscle, and brain, and nerve, and membrane, waste away like a burning taper, consume to air and ashes, and pass from the system, rejected and useless; and where no means are at hand for repairing these daily and hourly losses, the individual perishes—dies more slowly but not less surely, than by a blazing pile. He is, to the very letter, burned to death at a low temperature; the various constituents of the body give way in succession; first, the fat disappears;

* This fund owes is existence to the liberality of the late Samuel Acton, Esq., of Euston Square, Eng.

this is the most combustible; it is to be sacrificed; then the muscles shrink, and soften and decay. At last the substance of the brain becomes attacked, madness and death close the scene. This is starvation."

RURAL ECONOMY, in its relations with Chemistry, Physics and Meteorology, or CHEMISTRY APPLIED TO AGRICULTURE, by J. B. Boussaingault, Member of the Institute of France, &c. Translated, with an introduction and notes, by George Law, Agriculturist. New-York, D. Appleton, & Co. Philadelphia, George S. Appleton, 1845.

THIS work needs no commendation from us. The author's name is enough to insure it a careful perusal by all who look to science as the handmaid of agriculture. It contains a full system of farming in a summary way, the first part treating, in the words of the author's preface, "of the physical and chemical phenomena of vegetation—of the composition of vegetables and their immediate principles—of fermentation—and of soils. The second comprises a summary of all that has yet been done on the subject of manures, organic and mineral—a discussion of the subject of rotations—general views of the maintenance and economy of live stock—finally, some considerations on meteorology and climate, and on the relations between organized beings and the atmosphere."

We hesitate not to commend this work to all who seek the aid of science in the noblest and best of all pursuits, and we do it the more cheerfully, because we are heartily rejoiced whenever we see a work for the farmer, from a man who has devoted himself as has M. Boussaingault to their interests. He is a practical farmer, as well as an experienced and careful chemist, and it is not by following the opinions of any one man that the farmers are to succeed. They might read and think, and compare and reason in matters relating to their business, and in this way only can they become the class of men they ought to be in this country, and which we believe they are ere long destined to be.

The gentlemen Appletons have got this work up in excellent style.

UNITED STATES EXPLORING EXPEDITION.

WE received from Lee & Blanchard, Philadelphia, but too late for our January number, specimen sheets of this truly great work, by Charles Wilkes, U. S. N., Commander of the Expedition, &c.

The letter-press and engravings are in superior style. The work consists of "five magnificient large imperial octavo volumes—containing sixty-eight large steel engravings—forty-six steel vignettes—three hundred wood cuts—thirteen maps and charts, and twenty-five hundred pages letter-press. Price $25,00 to subscribers, done up in beautiful extra cloth binding.

THE FARMER'S MINE, or SOURCE OF WEALTH, being a compilation, with the addition of new and important information on the subject of manure, together with the most approved methods for the manufacture of vegetable manure, by which the farmer can obtain, in the shortest possible time, as much manure of the richest quality as he pleases—to which is added PRODUCTIVE FARMING, by Joseph A. Smith. By Henry Heermance. Revised and corrected by A. B. Allen, Editor of the American Agriculturist. New-York, published by Henry Heermance, and for sale by Saxton & Miles, office of the American Agriculturist, 205 Broadway. 1845.

THIS book, with this tremendous long title, contains a great deal of practical information for the farmer on the subject of manures, and is a compilation of the views of various authors on that subject.

THE CHEMISTRY OF VEGETABLE AND ANIMAL PHYSIOLOGY, by Dr. G. T. Mulder, Professor of Chemistry in the University of Utrecht. Translated from the Dutch, by P. F. H. Fromberg, First Assistant in the Laboratory of the Scotch Agricultural Chemistry Association, of Scotland. With an introduction by Professor J. F. W. Johnston, F. R. S. S., L. & E.

First authorized American edition, with notes and corrections by B. Silliman, Jr. Vol. I. Part I. No. 1. New-York, Wiley & Putnam. 1845. Price, 20 cents.

WE have read the first number of this work with attention, and have come to the conclusion that, thus far, it is the most philosophical treatise upon vegetable and animal physiology which has yet appeared. It is not a repetition of the views of Liebig or Boussaingault, or of any preceding writer. It is a work which stands by itself, and is made up of the matter and thought of Mülder with all the aid which cotemporary laborers can give in this prolific field of research. The names upon the title page are the

strongest testimony to the value of the publication which can be given. We like especially the size and typographical execution of the work. The paper is white, and the printing uniform and beautiful.

CATALOGUES.—We call the attention of our friends to a series of Catalogues, by Wiley & Putnam, Publishers and Importers of Foreign Books, 161 Broadway, New-York.

They are published in four divisions, viz:

I. Science, Natural History, Useful and Fine Arts.

II. History, Biography, and General Literature; Greek and Latin Classics, Philology, &c.

III. Theological Literature.

IV. Medical Literature, with copious appendices.

The subjects are classified, and each book has its price affixed. A list of all the Periodicals is subjoined, with their prices per annum. These catalogues are of great value as well as convenience to the reading community; they may be had *gratis* on application to the publishers.

STABLE ECONOMY, a treatise on the management of Horses in relation to Stabl ng, Grooming, Feeding, Watering and Working. By John Stewart, Veterinary Surgeon, author of "advice to purchasers of horses," and lately Professor of Veterinary medicine in the Andersonian University, Glasgow. New-York, D. Appleton, & Co. Philadelphia, G. S. Appleton.

THIS work was received too late for us to give it a perusal, but the name of A. B. Allen, editor of the American Agriculturist, who has prefaced it and adapted it to the wants of this country, will be sufficient recommendation of it to all who are interested in the use of that noble animal, the horse. In preparing it, Mr. Allen states that he has taken the liberty to correct many errors of the author, and in some instances to suppress "whole pages, all of which were either quite erroneous in matters of fact, or totally inapplicable to this country." We like this. Too much of imported knowledge is often unhesitatingly adopted in this country, and thus great mistakes committed.

EXTRACTS

FROM

DOMESTIC AND FOREIGN JOURNALS.

ON THE DISTRIBUTION OF MINERAL SUBSTANCES, IN INDIVIDUAL ORGANS OF PLANTS.

BY DR. A. VOGEL, JUN.*

It has been ascertained by direct experiment, that the quantity of inorganic matter assimilated by plants differs materiallyin the different organs to which it has been distributed. Hertwig, at the suggestion of Prof. Liebig, demonstrated that the earthy matter of the tubers of the potatoe plant, differed from those of the stalks, or the herbaceous parts. Vogel, Jun., in order to set at rest the question generally, undertook the examination of several species of plants, the results of which have established the fact, that the inorganic matters of the root, differ from those of the trunk, both in kind and quantity. The following may be stated as an example of the results which have been obtained by an analysis of the ashes of the different parts of a vegetable; the one employed was a species of pear. (Pyrus spectabilis.)

1. From the trunk, Vogel obtained from the ashes 82 per cent of carbonate of lime. And 8 per cent of the insoluble phosphates of lime and magnesia, with a slight admixture of magnesia.

2. The ashes of the leaves contain about 7 per cent of soluble alkaline carbonates, with traces of sulphate of potash, chloride of sodium, (common salt,) and phosphate of potash. The carbonate of lime, is 10 per cent less in the leaves than in the trunk. While the phosphate of lime and magnesia amount to 10. The quantity of magnesia is nearly twofold; 4.9 per cent, it is now 9.76 per cent.

3. The ashes of fruits contain of soluble parts 33.1 per cent. The quantity of carbonate of lime has diminished from 82 per cent, to 37 per cent, whereas the phosphate of lime and magnesia, has augmented to 18 per cent; the phosphoric combinations taken together, amount in the fruits to over one third, or to 36.38 per

* Annalen der. Chemie and Pharmacie, July, 1844.

cent. The quantity of iron too, diminishes from the trunk to the fruit.

GENERAL SUMMARY.

	Trunk.	Leaves.	Fruit.
Alkaline carbonates, ...	4.6	6.80	1.90
Carbonate of lime, ...	82.2	72.90	37.00
Alkaline phosphates, ...	....	traces	14.10
Carbonate of magnesia, ...	4.9	9.76	5.52
Phosphate of lime & magnesia,	8.8	10.50	18.60
Silica, ...	....	.....	3.70
	100.5	99.96	97.92

[From Chambers' Edingburgh Journal.]

NUTRIMENT.

Comparative quantity of nutriment in the various articles used for food among all nations; derived from a report of Messrs. Perey and Vanquelin, and presented to the French Minister of the Interior.

The result of the experiments of Messrs. Perey and Vanquelin is as follows:—In bread, every 100 lbs. are found to contain 80 lbs. of nutritious matter; butchers' meat, averaging the various sorts, 31 lbs.; French beans, 80 lbs.; pease, 23 lbs.; lentiles, 94 lbs.; greens and turnips, 8 lbs.; carrots, 14 lbs; potatoes, 25 lbs.

According to this estimate, 1 lb. of good bread is equal to 2 1-2 or 3 lbs. of the best potatoes; and 75 lbs. bread and 30 lbs. butchers' meat, are equal to 300 lbs. of potatoes; or again, 1 lb. of rice or of broad beans, is equal to 3 lbs of potatoes, while 1 lb. potatoes is equal to 4 lbs. of cabbage, and to 3 lbs. turnips. This calculation is considered perfectly correct, and may be useful to families, where the best mode of supporting nature should be adopted at the least expense.

One remark seems to be called for in connection with the above extract, viz: That it is rarely, if ever, proper to bring the condition of food into a concentrated state, so as to occupy the least possible bulk—or, in other words, to separate the nutritious from that which is not of this character. Some bulk is absolutely essential to health, and even to satisfy the cravings of the appetite; still, this comparative view of the different nutriments, is highly important, and not only worthy the attention of those who are charged with the duty of supplying food for families, but to those who feed stock; and we have no doubt, but the

real value of the different kinds of butchers' meat, depends greatly upon the food upon which the animals were fattened; and that there is at least one third difference between the value of meat fattened upon Indian corn, and the best of the roots which are generally substituted for it.—Eds.

SULPHUR IN PLANTS.

We do not speak of the existence of sulphur in plants as a new discovery, still it is a highly interesting fact, and deserving of careful investigation. Dr. Vogel, Senior, of Munich, has very recently called the attention of chemists to this subject. It appears that the cruciferœ as mustard, scurvy grass, &c., contains sulphur as a constituent principle, particularly the pepper-grass (Lepidium sativum.) It had been supposed that this substance was admitted into the plant from the soil, but from the experiments of Dr. Vogel, it appears that even when all substances containing sulphur, are excluded from an artificial soil in which pepper-grass has grown, and when watered with distilled water, that it still contains sulphur. This apparently puzzling fact, seems however, to be explained on the ground that plants obtain it from the atmosphere. If this conjecture is true, it leads to the establishment of the fact, that one or more of the compounds of sulphur exist constantly in the atmosphere. This compound is supposed to be sulphuretted hydrogen, which exists in all mineral water, termed hepatic, and also in all animals and vegetable products in a state of decay.

MEMOIR ON THE DISTRIBUTION OR APPROPRIATION OF LANDS.*

BY PROFESSOR LIEBIG.

The most attentive investigations concerning the animal bodies have shown that the blood, the bones, the hair, &c., as well as all the organs, contain a certain number of mineral substances. If these were not present in the food, their formation could not take place.

The blood contains potassa and soda, as well as compounds of these bases with phosphoric acid. The bile is rich in alkalies; the substance of the muscles contains a certain quantity of sulphur; the red coloring matter of the blood contains iron; the most impor tant principle of the bones is phosphate of lime; the nervous and celebral substance contains phosphoric acid and alkaline phosphates; the gastric juice, free hydrochloric acid.

We know that the free hydrochloric acid of the gastric juice, and a portion of the soda in the blood, arise from chloride of sodium; and that, by the simple privation of this salt, we put an end to digestion and life.

If we give for nourishment, to a young pigeon (*Chossat*, *Comptes Rendus de L'Academi des Sciences*, June, 1843), grains of wheat, in which the most important principle of its bones, phosphate of lime, is wanting, and if it be prevented from procuring elsewhere, the lime which is necessary for it, we perceive that its bones become more and more thin and fragile, and that the continued deprivation of this substance produces death. If we suppress the carbonate of lime in the nourishment of birds, they lay eggs deprived of the hard protective shell.

If we feed a cow with an excess of tubercles and roots, such as potatoes and beet-root, which contain phosphate of magnesia, but only *traces* of lime, the animal experiences the same fate as the young pigeon.

If we remove daily from the cow in its milk, a certain quantity of the phosphate of lime, without repairing this loss in its nourishment, this phosphate must be taken from its bones, which gradually lose their strength and solidity, and finally become incapable of supporting the weight of its body.

If we add to the nourishment of the pigeon, grains of barley or

* *Annalen der Chemie und Pharmacie.*

peas, or to that of the cow, barley straw or clover, which are rich in salts of lime, the health of the animal is sustained.*

Men and animals receive their blood and the principles of their bodies from the vegetable kingdom, and an inscrutable wisdom has ordained that the life and the vegetation of the plant should be connected by the closest links with the absorption of the same mineral substances that are indispensable to the animal organism. Without those inorganic matters which we know to be principles of their ashes, it is impossible to form an idea concerning the formation of the germ, of the leaf, of the flower, and of the fruit.

The quantity of the principles serving for the nourishment of animals is extremely unequal in the cultivated plants.

There is a much greater relation between tubercles and roots, with respect to their chemical principles, than with the seeds. The latter have always a similar composition.

Potatoes, for example, contain from 75 to 77 per cent of water, and from 23 to 25 per cent of solid substance. By means of a mechanical operation, we can decompose the latter into 18 or 19 parts of starch, and three or four parts of dry, amylaceous fibre. It is easy to see that the two combined, weigh almost as much as the dry potatoes themselves. The two hundredths which are wanting are formed of salts, and of the sulphuro-nitrogenous substance known under the name of albumen.

Beet roots contain from 88 to 90 per cent of water, 25 parts of beet roots contain very nearly the same elements as 25 parts of dried potatoes. We found from 18 to 19 parts of sugar, and 3 or 4 parts of cellular tissue; half of the two hundredths which are wanting is formed of salts; the rest is albumen.

Turnips contain from 90 to 92 parts of water. From 23 to 25 parts of dry turnips contain from 18 to 19 parts of pectine, with very little sugar, three or four parts of cellular tissue, and two parts of salts and albumen. Sugar, starch, and pectine contain no nitrogen; they are met with in plants in the free state, never in that of combination with salts or alkaline bases. These are combinations formed by the carbon of the carbonic acid, and the principles of water, whose elements take the form of starch in the potatoe, that of sugar in the beet-root, and that of pectine in the turnip.

We have as a sulphuro-nitrogenous principle, in the seeds of cereals, *vegetable fibrin*; in peas, beans, and lentils, *casein*; in the

* The workmen, in the mines of South America, whose daily work (perhaps the hardest in the world,) consists in raising on their shoulders, from a depth of 146m. 178, a charge from the mine of the weight of from 90 to 100 kil., live only on bread and beans; they would prefer bread alone for their nourishment; but their masters, who have found that they cannot work so hard with bread alone, treat them like horses, and force them to eat beans, [Darwin, *Journal of Researches*, p. 324.] But beans contain proportionally, much more of the earthy substance of the bones than bread.

seeds of oleaginous plants, *albumen*, and a substance greatly resembling casein.

The vegetable fibrin of the seeds of cereals is accompanied by starch. This same body is a principle of the pods of leguminous plants. In the oleaginous seeds the starch is replaced by another nitrogenous principle, analogous to oil, butter, or wax.

It is evident that, according to the object of culture, and according to the principles which we wish to obtain, we should present to plants the conditions necessary for their production. Sugar and starch require the addition of other substances than the sulphuro-nitrogenous principles.

To furnish to the potatoe and the beet-root the necessary principles of their leaves, that is to say, organs destined for the absorption and assimilation of carbonic acid, is to fulfil the conditions of the formation of starch and sugar.

The juice of all vegetables rich in sugar and starch, and most of the ligneous plants, is rich in potassa, soda, or the alkaline earths. These alkalies and alkaline earths cannot be considered as accidental principles; we must suppose that they answer certain objects in the organism of the plant, and that they are absolutely necessary for the formation of certain combinations. I have said that they are combined in plants with organic acids which characterize some kinds of vegetables, so that they are never wanting. The organic acids themselves should be the intermedia of certain vital functions in the organism of the plant. Now, if it be borne in mind, that fruits, before arriving at maturity, grapes for example, are not eatable on account of their great quantity of acid, that these fruits act absolutely like leaves in the solar light, endowed, as they are, with the power of absorbing carbonic acid, and of eliminating oxygen (De Saussure); that the augmentation of the sugar coincides with the diminution of the acid, we can scarcely help thinking that the carbon of the organic acid in the fruit, before its maturity, becomes a principle of sugar in the ripe fruit, that it is thus, by an elimination of oxygen, with an assimilation of the elements of water, that the acid is converted into sugar.

The tartaric acid in grapes, the citric acid in cherries and gooseberries, and the malic acid in summer apples which ripen on the trees, are, therefore, the intermedia of the conversion of carbonic acid into sugar; deprived of the proper temperature, and of the action of the solar light, they would not undergo the changes of this metamorphosis.

Now, we see in the sorb apple of bird-catchers (*sorbier des oiseleurs*,) the tartaric acid replaced by malic acid, the more oxygenous acid by the acid containing less oxygen; we see the malic acid gradually, almost completely disappear from these fruits, and we find in its place gum and mucilage, which did not previously exist in them, and, consequently, we have reason to admit the con-

version of the carbon of the tartaric acid into that principle of malic acid which succeeds to it, a transformation not easily involved in doubt, as much as we have to attribute it to the metamorphosis of those acids into sugar.

The opinion that a plant assimilates carbonic acid, that this carbonic acid takes in its organism the forms of tartaric, racemic, and citric acids, only to be finally converted into carbonic acid; this opinion, I say, cannot be reasonably sustained.

If this mode of view relative to the part which organic acids take in the formation of sugar be confirmed, it should have the same value relative to the formation of all the other non-nitrogenous substances of similar composition; the formation of starch, pectine, and gum, is not, therefore, immediately produced, without transition, by the carbon of the carbonic acid, and the elements of water; but a gradual transformation is operated in consequence of the production of combinations which become, by degrees, more poor in oxygen, and richer in hydrogen. The formation of oil of turpentine cannot be represented without the production of analogous intermediate bodies.

But if the organic combinations, rich in oxygen, *the acids*, are the intermedia of the production of those which contain less oxygen, sugar, starch, &c., it is clear, that in cultivating plants, in which the acids are rarely in the free state, but in which they ordinarily exist under the form of salts, the alkalies and the alkaline bases should be regarded as the conditions of the production of the non-nitrogenous principles. Without the presence of these bases, an organic acid may, perhaps, be formed; but, without the acid, neither sugar, starch, gum, nor pectine, can be formed in the organism of these plants. In the fruits and seeds, in which the organic acids are free, that is to say, not in the state of salts, such as citric acid in lemons, oxalic acid in chick-peas, sugar is not formed. Sugar, gum, and starch, are produced only in the plants in which the acids are found combined with bases, which are met with in plants.

Whatever may be the value which may be accorded to this opinion concerning the part performed by alkaline bases in the vital act of vegetables, the positive fact that, in young shoots, the leaves and buds which are developed, consequently in the parts of the plants in which the faculty of assimilation is observed in its greatest force, the proportion of alkaline bases is most considerable that the vegetables most rich in starch, are not less distinguished by their richness in alkaline bases, and in organie acids; this observation, I say, cannot, on account of this view, lose its value in rural economy.

If we find sugar and starch accompanied by salts, formed by organic acids, and if experience demonstrates that, without alkaline bases, all the development of the plant, the formation of sugar,

of starch, and of ligneous fibre, are found restrained; that their presence gives activity to, and augments, its vegetation, it is clear that if in culture a maximum of product should be attained, it is not by an excess of carbonic acid and humus that it can be effected, if we do not present to the plants, in great quantity, and in a state appropriate to absorption, the alkalies which are the principal conditions of the conversion of carbonic acid into sugar and starch, whatever may be the manner in which they may contribute to this result.

The oxalic, tartaric, citric, and malic acids, &c., are produced in the organism of the plant: their carbon arises from carbonic acid.

We find, in vegetables, these acids combined with potassa, lime and magnesia, in the state of salts, the smallest parcels of which, abandoned to themselves, follow their own attractions, as is seen in their tendency to crystallize.

It cannot be doubted that these combinations do not possess the character of organic life, precisely because the force which appears to be in activity in them is not the vital force, but the force of cohesion. It must be quite the same with sugar, which is, likewise, crystallizable.

We should suppose that the smallest parcels of the products, whose formation is due to carbonic acid, are subordinate to the activity which, in the living plant, reacts on them, like the smallest parcels of carbonic acid itself; that, thus, the carbon of the oxalic and tartaric acids, &c., should possess the faculty of becoming the principle of an organ endowed with vital force.

It is easy to pursue this metamorphosis in the organic acids. If we represent 12 equivalents of our carbonic acid as losing (in presence of a base, and under the influence of light, in consequence of the action of the vital force of its elements), the fourth of its oxygen, we have oxalic acid. This acid may be imagined in the anhydrous state, by supposing that the carbonic acid has not given rise to it in any other manner:—

$$C^{12}O^{24}—O^{6}=C^{12}O^{18}=6 \text{ eq. of anhydrous oxalic acid.}$$

The oxalic acid does not exist in the anhydrous state. In the state of hydrated oxalic acid, it contains 1 eq. of water; the salts of potassa, lime, and magnesia, likewise contain water. Hydrated oxalic acid is formed of:—

$$C^{12}O^{18}+6 \text{ eq.}=C^{12}H^{6}O^{24}=6 \text{ eq. of hydrated oxalic acid.}$$

It is easy to observe that carbonic acid and hydrated oxalic acid contain an equal quantity of oxygen. We may, therefore, here represent hydrated oxalic acid as carbonic acid, into the composition of which a certain quantity of hydrogen enters.

If the continuation of the influence of the activities eliminates

from oxalic acid fresh portions of oxygen, we have tartaric or malic acid. Tartaric acid is formed by the elimination of 9 equivalents of oxygen: the separation of 12 equivalents of the same element gives rise to malic acid.

Hydrated oxalic acid $C^{12}H^{6}O^{24}—O^{9}=3$ eq. of tartaric acid.
" " " $C^{12}H^{6}O^{24}—O^{12}=3$ eq. of malic acid.

It is by a simple separation of water from the elements of malic acid that citric acid is formed; we know, that by the sole influence of heat, we can produce, with citric acid, *aconitic acid*, and with malic acid *lichenic* and *maleic acids*.

Malic acid $C^{12}H^{6}O^{12}—$ Aq$=C^{12}H^{5}O^{11}=3$ eq. of citric acid.
" $C^{12}H^{6}O^{12}—3$ Aq$=C^{12}H^{3}O^{9}=3$ eq. of lichenic acid.

We may now consider the tartaric and malic acids as combinations of oxalic acid with sugar, gum, ligneous fibre, or their elements.

$$\underset{\text{Tartaric acid.}}{2\,(C^{12}H^{6}O^{15})} = \underset{\text{Oxalic acid.}}{C^{12}O^{18}} + \underset{\text{Dry grape sugar.}}{C^{12}H^{12}O^{12}}$$

So that, consequently, by the addition of new quantities of hydrogen, all these acids may contribute to the formation of sugar, starch and gum. In this metamorphosis, the alkalies, which were combined with the acids, should, as is self-evident, be set at liberty; they should recover the faculty of again performing the same parts. It may, therefore, be believed that one equivalent of alkali may serve for converting 10, 20, and even 100 equivalents of carbon into a principle of the plant. It is by time alone that the quantity of the base present produces any difference.

If a living evergreen plant assimilates, throughout the year, with the assistance of a given quantity of potassa, a certain quantity of carbon under any form whatever, a summer plant requires nearly four times as much potassa to assimilate the same quantity in one-fourth the time.

Gay Lussac first observed that oxalic, tartaric, and citric acids, and sugar, ligneous fibres, &c., are brought to the state of carbonic acid by the contact of an alkali, at a high temperature.

This course of decomposition is precisely the inverse of that which occurs in plants. In the latter, the elements of water are added to the combination of carbon to the carbonic acid, oxalic, and tartaric acids, &c., are formed, *owing to a separation of oxygen.*

In the chemical operation indicated, the elements of water in presence are added to those of the oxalic and tartaric acids, &c.; they are brought to the state of carbonic acid *by a separation of hydrogen.*

Without disengagement of any gas, from the fact of the presence of an alkali, the tartaric and citric acids are already divided, at a

temperature of 392° F., into oxalic and acetic acids. But the anhydrous acetic acid contains carbon and the elements of water, precisely in the same relative proportion as ligneous fibre (Peligot) which, in perfectly similar conditions, also gives acetic acid.

This mode of decomposition has led a distinguished French chemist to admit the existence of oxalic acid ready formed in tartaric acid. At all events, its elements are formed in it by the side of a second body, which, like sugar, gum, and ligneous fibre, may be regarded as a combination of carbon with water.

Every part, every principle, of the animal body is derived from plants. It is by the organism of plants that the combinations which serve to sanguification are formed; it cannot be doubted that the parts of the plants serving as food contain, not only one or two, but all the principles of the blood.

We cannot believe in the possibility of the formation of blood in the body of an animal, or of milk in that of a cow, if there be wanting in their food one of the principles which should be regarded as conditions of equal necessity for the sustenance of all the vital functions.

The sulphuro-nitrogenous substances, as well as the alkalies and the phosphates, are principles of the blood; we cannot conceive the passage of the former into this fluid without the presence and concurrence of the latter.

The faculty possessed by a portion of the plant of sustaining the life of an animal, and of increasing the mass of its blood and flesh, is, then, in direct ratio with its richness in the organic principles of the blood and with the quantity of alkalies, phosphates and metallic chlorides (chlorides of sodium or potassium) necessary to their passage into the blood.

It certainly is a highly remarkable fact, and of great value to agriculture, that the sulphuro-nitrogenous vegetable substances, which we have designated as organic principles of the blood, are, in all the parts of plants in which they are found, always accompanied by alkalies and phosphates.

In the juice of potatoes and of beet-roots the vegetable albumen is accompanied by alkaline salts and soluble phosphate of magnesia; we have in the seeds of peas, lentils and beans, and in those of cereals, alkaline phosphates and earthy salts.

The seeds and fruits in which the organic principles of the blood are found in greater abundance, contain also a predominating quantity of the inorganic principles, the alkalies and phosphates; and in the other substances, such as potatoes and roots, which are proportionally so poor in the former, the latter exist also in a much smaller quantity.

The simultaneous presence of the two classes of combinations is so constant, that an intimate connexion cannot be doubted. It is extremely probable that the production and formation of the

organic principles of the blood in the organism of the plant, are connected by the strongest ties with the presence of the alkalies and phosphates.

We should suppose that even with the introduction of the greatest quantity of carbonic acid, of ammonia and of the sulphates, which furnish the sulphur, the organic principles of plants would not be produced in the form appropriate to their conversion into blood, if the alkalies and phosphates by which we always find them accompanied were wanting.

But even admitting that they might also be produced in the organism of the plant, without the concurrence of these substances, they could not be converted in the body of the animal into either blood or flesh, if the mineral principles of the blood were wanting in the part of the plant given as food.

Apart from all theoretical considerations, the judicious agriculturist should then, with relation to the objects he has in view, proceed precisely as if the production of the organic principles depended on the presence of the inorganic principles of the blood (the phosphates and alkalies); he should give his plants all the principles necessary to the formation of the leaves, stems, and seeds; and if he wish to attain on his fields a maximum of blood and flesh, he should add in greater quantity those of their principles which the air cannot furnish.

Starch, sugar, and gum contains carbon and the elements of water: they are never found associated with the alkalies; they do not contain phosphates. It may be believed that in two varieties of the same plant, by the addition of an equal quantity of the mineral elements, very unequal quantities of starch or sugar are formed, that from two equal surfaces of land prepared in precisely the same manner, and sowed with two varieties of barley, we might collect on one, one and a half, or even twice, the weight of seeds on the other; but this excess of product can have relation only to their non-nitrogenous, and not to their sulphuro-nitrogenous principles: for an equal quantity of the inorganic principles of the blood added to the soil and passed into the plant, there should be formed in the seeds a quantity of inorganic principles which corresponds to them; in short, it cannot be found more in one than in the other.

It will be only the introduction of a less quantity of nitrogen into a plant during the lapse of time given, which will produce a difference: it will be owing to the want of ammonia that a corresponding quantity of the inorganic principles of the blood will not find employment.

Of two kinds of different plants which we cultivate on a field of the same nature, that one will remove from the soil the greatest quantity of the inorganic principles of the blood (phosphates), in the organization of which will be produced the greatest quan-

tity of the organic principles of that fluid (sulphuro-nitrogenous compounds).

One of the plants will exhaust the ground of these principles, whilst with the same conditions of culture for the other, which has removed from it a smaller quantity of phosphates, it will still remain fertile for a third kind of plant.

This is, therefore, the reason why with the development of certain parts of plants which, such as the seeds, much exceed all the others in their richness in the organic principles of the blood, the soil loses much more of the phosphates, and is exhausted much more than by the culture of herbaceous plants, or of tubercles and roots which contain very little of them in proportion.

Besides, it is clear that if two plants which require in equal times the same quantity of the same principles, grow side by side on the same ground, they will partake the principles of the latter. That which one of them introduces into its organism, the other cannot appropriate.

If the soil on a limited space (surface and depth) contain not more of these inorganic aliments than ten plants require for their complete development, twenty of the same plants cultivated on the same surface will attain only half their development: the number of their leaves, the strength of their stems, and the number of seeds should present a difference.

Two plants of the same nature should be reciprocally injured, if grown within a certain distance they find in the ground or in the atmosphere which surrounds them a less quantity of the aliments which are necessary for them, than they require for their complete development. There is no plant more injurious in this manner to a plant of wheat than a second plant of wheat, or to a potatoe plant than another potatoe plant. We find, indeed, that cultivated plants greatly excel at the border of the fields, in strength and in number of seeds and tubercles, those which grow in the middle.

But the same case should be reproduced, in a perfectly similar manner, if we cultivate the same plant no longer by the side of the other, but one after the other during several years on the same soil. Let us admit that the soil contains a quantity of silicates and phosphates sufficient for 1,000 crops of wheat, it will be sterile for the same kinds of plants after 1,000 years. Let us represent the surface of this field as exhausted to the bottom which nourishes the roots of the plants of the first crops; let us replace the bottom by the surface, and the surface by the bottom, and we then have a new surface, which, being much less exhausted, again ensures us a series of crops: but this state of fertility also has limits.

The less rich the soil is in these mineral aliments, so indispensable to plants, the sooner will the period of exhaustion arrive: but it is clear that we restore it to its primitive state of fertility by

reëstablishing its original composition, and consequently, by returning to it the principles which we had reaped and removed in the plants.

Two plants may be cultivated side by side, or one after the other, if they require unequal quantities of the same principles in unequal times; they will not be injured, and their vegetation will be beautiful, notwithstanding their proximity, if they require for their development different principles of the soil.

The investigations of M. de Saussure and many other naturalists, have shown that the seeds of the *Vicia faba* of the *Phaseolus vulgaris*, of peas and garden cress (*lepidium sativum*,) germinate and are developed to a certain degree in wet sand, and in horse-hair kept in a state of humidity; but when the mineral substances contained in the seed are no longer sufficient for the further development of these plants, they begin to droop; they sometimes flower, but they never produce seeds.

Wiegmann and Polstorff made plants of different kinds vegetate in white sand boiled with aqua regiâ and freed from acid by careful washing;* barley and oats sown in this sand, and sufficiently moistened with water free from ammonia, reached the height of 0m487; they flowered, but produced no seeds, and perished after flowering. The *Vicia sativa* attained the height of 0m27, flowered, and produced husks; but they contained no seed.

Tobacco sowed in this land presented a perfectly normal development; but from June to October, the little plants attained only the height of 0m14: they had only four leaves without stalks.

The examination of the ash of these plants, as well as the analysis of the seeds, showed that this land, sterile as it was by itself, and poor as it was in potassa and soluble principles, nevertheless yielded to them a certain quantity of these substances which had served for the development of the stalks and leaves. But these plants could not bear seed, because evidently there was a complete absence of the substances necessary for the formation of the principles of the seeds.

In the ash of most of the plants grown in this sand, might the presence of phosphoric acid be demonstrated; but it corresponded only to the quantity of that acid introduced into the soil by the seed. In the ash of tobacco, whose seeds are, as is known, so small that the phosphoric acid which they contain eludes analysis, it was impossible to detect any trace of it.

* This sand contained in 1,000 parts:

Silica	979.00
Potassa	3.20
Alumina	8.76
Peroxide of iron	3.15
Lime	4.84
Magnesia	0.09

Wiegmann and Polstorf demonstrated the accuracy of the theoretical opinions relative to the cause of the sterility of this sand. They took the same sand, and prepared with it, by the addition of salts obtained in a purely artificial manner in a laboratory, a soil likewise artificial; they sowed in it the same plants, and found them to thrive in it very well. The tobacco shot forth a stem more than a metre in height, and many leaves; it flowered on the 25th June, produced seeds about the 10th August, and on the 8th September ripe capsules were collected with perfectly developed seeds.

Barley, oats, buck-wheat, and clover were developed in a perfectly similar manner: they all came up well; they flowered and produced ripe and perfect seeds.

It is quite certain that the fine vegetation of these plants in this sand, previously quite barren, depended on the salts added. This artificial soil owed its equal fertility for all these plants to the addition of certain substances whose presence might be demonstrated in the perfectly developed plant, in the stem, leaves and seeds, and whose existence in the soil and in the vegetables, puts beyond doubt their necessity for the life of the plant.

We can, therefore, give the most barren soil the greatest fertility for every kind of plants, by furnishing to it the principles which are necessary for their development. In fact, to endeavor to render fertile, according to these principles, a completely barren sand, requires neither trouble nor expense; but by applying them to our ordinary lands of culture, which already contain in themselves a great number of these substances, it is sufficient to furnish those which are wanting, to increase those which are found in them in too small quantity, and to give to the soil, by the art of agriculture, the physical properties which render it permeable to the humidity of the air, and permit plants to appropriate these principles of the soil.

Different kinds of plants require for their vegetation and complete development, the same inorganic aliments, but in unequal quantity or unequal times; or else they require different mineral substances. It is to the difference of the aliments necessary to their development, which the soil presents, that it must be attributed, if certain kinds of plants, growing side by side, are mutually arrested in their development; and if others, on the contrary, in the same condition, present a rich vegetation.

If, indeed, we compare the principles of the ash of the same plant which is developed, in different soils, we find only very slight differences in its composition. We have, as an invariable principle, in the straw of the graminacæ, silicic acid and potassa, and in their seed phosphates of potassa and magnesia; in the straw of peas, and in clover, an abundant quantity of lime is

found. We know, besides, that in certain kinds of plants, potassa may be replaced by soda, and lime by magnesia.

It results, moreover, from the investigations of M. Boussaingault (*Annales de Chimie et de Physique*, 3d Série, t. i. p. 242), that on an equal surface (4 acres [?]) of the same field manured once, there will be removed from the soil, by five successive crops :—

			Principles of the soil.
1st year, by a crop of	potatoes (tubercles without stalks or leaves)	..	246.8 lb.
2d "	"	wheat (straw and grain)	371.0 "
3d "	"	clover	620.0 "
4th {	"	wheat*	488.0 "
}	"	peeled turnips	108.8 "
5th "	"	of oats (straw and grain)	215.0 "
By a crop of beet-roots† (roots without leaves)			399.5 "
	"	peas (seeds and straw)	618.0 "
	"	rye	284.6 "
	"	artichokes (hel. tuberosus)	660.0 "

Of these numbers which express the quantities of inorganic substances extracted from the same soil by different plants, and extracted or removed consequently in the crop, it results that different plants introduce into their organism unequal weights of these principles of the soil.

The attentive examination of the principles of their ashes shows, moreover, that they differ essentially with respect to their quality. 1000 parts of beet roots, potatoes, or turnips, leave, by cultivation in the dry state, 90 parts of easily fusible ash, containing a great quantity of carbonate of potassa and salts, with alkaline bases. Of these 90 parts, 75 dissolve in cold water.

2000 parts of dried fern likewise give 90 parts of ash; but of these 90 parts, nothing dissolves in water, or only a trace is dissolved. (Berthier.)

It is the same with the ash of wheat straw, and those of barley, peas, beans, tobacco, &c. With equal weights to their ash, very unequal quantities of its principles dissolve in water. Some ashes are completely soluble in water; some are only half soluble in it; and again others contain only traces of principles soluble in water.

If we pour an acid—hydrochloric acid, for example—on the portions of ashes insoluble in water, we find that with a great number of plants, the residue left by the water is completely soluble in the acids (beet roots, potatoes, turnips, &c.); that with others, only half of these residues are dissolved in the acid, whilst

* In a second and third *assolement*.

† In the quinquennial crop above referred to, wheat is mentioned twice. In the second year, by a crop of wheat, 371 lbs., and in the fourth year, 488 lbs. of inorganic principles were removed from the soil. This difference is owing to the unequal quantity of straw and grain which were collected in these two years. In the one, the combined weight of the straw and grain was 8,790 lbs.; and in the other, on the contrary, 10,858. The relative proportion of these ashes was absolutely the same as these numbers.

the other half finally resists; that with others, only one-third, or less, is dissolved.

The principles of the ashes of plants which are soluble in cold water, are formed, without exception, of *salts with alkaline bases* (*potassa* and *soda*); those soluble in the acids, are *salts of lime and magnesia*. The residue insoluble in the acids is *silica*.

The unequal portion of these principles, which are so different in their mode of acting with water and the acid, enables us to divide plants in culture into *plants containing potassa*, which contain more than half their weight of soluble alkaline salts; into *plants containing lime*, in which the calcareous salts predominate; and into *plants containing silica*, in which there is a predominance of silica. These are precisely the principles which are necessary to them in very great quantity for their development, and which essentially distinguish them from each other.

[Continued from number 1, page 137.]

EXPERIMENTS AND OBSERVATIONS ON THE PRODUCTION OF BUTTER.

BY PROFESSOR TRAILL.

Series 1.

The comparative value of the first and last portions of the milk.

For this purpose a cow was selected which had calved five weeks before, and the experiments were begun on Monday, 26th May, 1806.

No. 1 was the first pint milked.

No. 2 was a pint of the whole milking, after the separation of No. 1 and No. 3.

No. 3 was the last pint of the milking, or *afterings*.

As in previous experiments, *scalding* the milk was found to favor the more perfect separation of the butter, after the three portions were allowed to remain twenty-four hours in the milkhouse. They were at the same time placed in earthenware basins, in a pan of water heated to 180° Fahr. They were removed within an hour from the water, when the milk had acquired a temperature of 130°. They were replaced for ten hours in the milkhouse, and then examined. No. 1 then showed scarcely any indication of cream. It formed a very thin pellicle only; and the quantity, being too small to be churned, was estimated from other comparative trials, to be no more than equivalent to five grains of

butter. No. 2, was evidently richer to the eye, but the cream was pale-colored, and, when churned, yielded 181 grains of firm butter. No. 3, the cream, before churning, had a rich yellow tint; the butter produced was well flavored, and weighed 551 grains. The difference between the richness of the first milk and the afterings, in a cow yielding about fifteen pints of milk at each milking, is thus as 1 : 110.

When a cow has calved less recently, the difference between the first milk and afterings, however, appears not so great. On the 9th of August, the milk of the same cow, which then yielded fourteen and a half pints at a milking, was subjected to experiment in a similar manner.

The three portions were placed in similar basins in the milk-house for forty hours, and were then scalded till the temperature of the milk rose to 145°. The milk was drawn off next day from below the cream by means of a siphon, and the three portions were churned, in glass vessels, at the same time, for thirty minutes. The butter was soft and very white, although it was allowed to remain for twenty-four hours after churning in cold water. This probably arose from the heat of the weather; the thermometer in the shade then standing as high as 73°. When the butter was washed, and worked to free it from water,

No. 1	yielded	31	grains.
No. 2	"	252	"
No. 3	"	416	"

Here the proportion between the first and last milking is as 1 : 13.42 nearly, or 1 : 13½.

On this occasion, we took the opportunity of repeating an experiment formerly made on the proportion of caseine or curd in each of those portions of milk, by coagulating small but equal parts of each by means of rennet, and also by sulphuric acid, which we had found to afford a larger and more firm curd than rennet. Two ounces of each portion of the milk, after the cream was removed, were measured out, (that is, one-eighth of an English pint;) a teaspoonful of filtered rennet was added to each; to equal quantities of the same milk forty drops of sulphuric acid were added; and the six cups were placed in boiling water for some minutes. They were all firmly coagulated. The curd was separated from each; and, when equally dried, in a heat about that of boiling water, each was accurately weighed.

	With Rennet.		With Sulphuric Acid.
No. 1	gave of dry curd 14 grains.	...	18 grains.
No. 2	" " 13 "	...	18 "
No. 3	" " 14 "	...	19 "

This shews that, though the quantity of oily matter differs ma-

terially in the first milk and the afterings, the proportion of caseine or curd differs but little.

The experiments shew the caseine obtained from each pint to be equal to—

	With Rennet.		With Sulphuric Acid.
No. 1 ..	112 grains of curd.	...	144 grains.
No. 2 ..	104 " "	...	144 "
No. 3 ..	112 " "	...	171 "

Series 2.

Comparative quantity of butter yielded by

No. 1. Sweet cream churned alone.
No. 2. Sweet milk and its cream churned together.
No. 3. Sour cream churned alone.
No. 4. Sour milk and its cream churned together.
No. 5. Scalded cream, or Devonshire cream, churned alone.

On the 24th May, 1807, the milk of four cows was drawn in the same vessel, passed through a strainer, and then divided into five portions of six English pints each, which were placed in similar basins of earthenware, in a milkhouse, the temperature of which ranged from 55° to 60° Fahr.

Monday, 25th.—The temperature of the air was very hot, 76°; but that of the milkhouse, by constant evaporation of water, was kept about 60°.

Tuesday, 26th.—Thirty-nine hours after the milk had been drawn from the cows, it was removed from below the cream of No. 1 and No. 3, by a siphon; and we immediately began to churn the cream of No. 1, and the milk and cream of No. 2, in glass vessels.

No. 1. *Sweet cream churned alone.*—Having previously found that the addition of a small quantity of cold water to thick cream facilitated the separation of the butter, half-a-pint of water was added to the cream, and it was found that the temperature of the mixture, at the commencement of the churning was 62°. In fifteen minutes, butter appeared in grains; the churning was continued for twelve minutes longer, *i. e.* twenty-seven minutes in all, when the temperature of the whole had risen to 70°. The butter was now collected into one mass; but, from the warmth of the weather, was very soft. It was, therefore, put into cold water, and placed in the milkhouse until the morrow, when it was worked and washed in the usual way, and weighed 1386 grains. It was of a good color, and perfectly well flavored.

No. 2. *Sweet milk and its cream churned together.*—The mixture of sweet milk and cream was churned at the same time; but, though cold water was here added, after one and a half hour's

churning, no butter was to be seen. The churning was continued for as long, (in all for three hours,) but without our obtaining a particle of butter.

No. 3. *Sour cream churned alone.*—On *Thursday*, 28*th May*, the cream of No. 3, which had been separated on Tuesday, and placed in a milkhouse, was now slightly acid, and was churned, after half a pint of cold water had been added to it. In twelve minutes butter appeared; and in eight minutes more, it had united into one mass. During the churning, the temperature of the cream had risen from 54° to 63°. The buttermilk was very poor, fit only for pigs. The butter, when well washed, and worked to separate the watery part, weighed 1756.5 grains. The color and taste were very good.*

No. 4. *Sour milk and its cream churned together.*—On the same day, 28*th May*, the milk and cream which had become acid were churned together, and half a pint of cold water was added. It was fully fifty-seven minutes before any butter appeared; and before the churning seemed to be completed, one hour and fifty minutes had elapsed. This shews that much more time is required to churn milk and cream together than to obtain the butter from cream alone. The butter was, in this instance, diffused in small grains, and, when washed and worked as long as any color was communicated to the water, it weighed 1968 grains. Its color was rather paler than the last, but its flavor was good.†

No. 5. *Clouted cream churned alone.*—On *Tuesday* 26*th*, the milk and cream of No. 5 were placed in a vessel of warm water, until the temperature of the milk rose to 156°. In these experiments on scalded cream we had the assistance of a Devonshire dairymaid, to superintend this part of the process. She generally placed the vessel containing the milk among the embers of a low fire; but we preferred water as the heating medium. She judged of the due degree of heat merely by dipping her finger in the milk, and the wrinkling of its surface; and we found that the heat considered by her sufficient generally ranged from 135° to 156°, and was occasionally as high as 160° or 162° Fahr. The milk was drawn from below the cream by a siphon; and the latter was placed in the milkhouse, until the following day, before it was churned. It was churned on Wednesday, the 27th. The milk of this portion was very poor, had a scalded taste, and would have been unsaleable.

I may here state that, by churning the milk of No. 1 and of No. 3., we could obtain a few more grains of butter, on some oc-

* The buttermilk from cream alone was poor and thin, in this and in all our experiments, whether water had been added to the churn or not.

† The buttermilk from No. 4—that is, from churning milk and cream together, when slightly acid, is a bland, agreeable fluid, containing much albumen or caseine. It finds a ready market in towns, and is much used in Lancashire as an article of diet. It is, therefore, a valuable product which ought to be considered in an economical point of view.

casions; but we never could obtain the smallest quantity of butter from the milk of No. 5—so completely does the scalding process separate the butyraceous matter from the milk. The butter of No. 5, when well worked and washed, weighed 1998 grains. It had a rich yellow color, tasted agreeably, and was quite free from the peculiar scalded flavor of the milk.

SERIES 3.

This series, a repetition of the preceding experiments, on the milk of four other cows, was commenced on *Thursday the 25th of June*, 1807, or a month after the last series. As before, the whole milk was mixed, strained, and divided into five equal portions, of six pints each, which were treated as the last.

No. 1. *Sweet cream churned alone.—On the 26th*, or in twenty-four hours after the milking, the milk of No. 1 was drawn off by the siphon. The temperature of this portion, at the commencement, was 62°; and when the churning was finished, had only attained to 65°. The churning required forty-five minutes. Water had been added as before, and the butter was obtained in grains like peas. When well worked and washed, it weighed 1147 grains. Its color was good and its flavor excellent.

No. 2 *Sweet milk and its cream churned together.*—The sweet milk and cream churned together afforded no butter.

No. 3. *Sour cream churned alone.—On the 29th of June*, the cream, which had become sour, was separated by the siphon and churned. The temperature at the commencement, was 58°—at the end, it was 65°, The butter was fully formed in forty minutes, and united into one mass. Well worked and washed, it weighed 1247 grains. Its taste was good as was its color.

No. 4. *Sour milk and its cream churned together.*—At the same time, the sour milk and cream were churned, with the same precautions as before. The churning occupied two hours; when the temperature had risen from 58° to 68°, or nearly 69°. When worked and washed, the butter weighed 1447 grains. The qualities equalled that of No. 3.

No. 5. *Clouted cream churned alone.*—The cream of this portion was scalded on *Friday, the 26th June*, by being heated to 160°, which temperature it attained in one hour, the usual time required for this operation. On *Saturday, the 27th*, it was churned in forty-five minutes; during which process the temperature of the cream rose from 58° to 64°. When well washed and worked, it weighed 1591 grains. The butter in the mouth had a granular feel, which we attributed to the heat rising, by accident, too high; by which an unusual portion of caseine appeared to be separated with the cream. The butter had, however, no peculiar flavor from the process; although the milk would have been unsaleable, from a strong taste of *scalding*.

The general result of these experiments, confirmed by many similar trials is, that the largest quantity of buttter is produced from the scalded or Devonshire cream; the next in quantity from the method of churning the milk and cream together, when they have become slightly acid; the third in quantity is afforded by cream kept till it is slightly sour; the smallest quantity is obtained from the sweet cream. We were unable to obtain butter from churning sweet milk and cream together; and in several other series attempted it no more.

In one series of experiments we used as much as 11¼ English pints of milk in each experiment; but we then had to churn in vessels of tinned iron; and we did not find the results so uniform as when operating on smaller quantities in glass vessels.

Series 4.

This series was intended to decide on the qualities of the butter obtained by the four processes above detailed, as to keeping fresh. These experiments were made, as those of the next series, on the butter obtained in most of our experiments. No. 1 always remained, when exposed freely to the air, longer without any rancid taste than any of the other kinds of butter. No. 3 and No. 4 were nearly on an equality in this respect: if there was any difference it was in favor of No. 3. No. 5 became rancid more quickly than No. 3 or No. 4.

Series 5.

Equal quantities of butter obtained by the four processes were salted with equal quantities of salt, then spread thinly on glass plates, and exposed to the air in a dry room. They were inspected from time to time, and it was ascertained that the taint of rancidity always appeared in the following order, commencing with that which shewed it first:—

In No. 5, or butter from scalded cream.
" No. 4, " " a mixture of sour milk and its cream.
" No. 3, " " sour cream.
" No. 1, " " sweet cream.

The cause of this difference in their power of resisting decay was believed to depend on the varying proportions of caseine, or curdy matter, in each. To determine this point another series of experiments was undertaken.

Series 6.

Two hundred grains of each kind of butter were kept liquified, by a moderate heat, in glass capsules; the oily matter was taken up by bibulous paper successively applied, as long as any oily stain was perceptible; the watery liquid which remained below the oily matter was evaporated, and the solid residue, after being

well washed, squeezed between folds of blotting paper, and dried, was carefully weighed. Unfortunately I have been unable to recover the details of this series of experiments; but the following are the general results, which decidedly shew that the presence of the greater quantity of caseine in butter coincides with its greater tendency to become rancid. The four kinds of butter afforded caseine in the following order, commencing with that which yielded the most:—

No. 5, butter from scalded cream.
No. 4, " from acid milk and its cream.
No. 3, " from acid cream.
No. 1, " from sweet cream.

Experiments had been made in *October*, 1806, which proved that *overchurning*—that is, continuing the process after the full separation of the butter—was very injurious to the quality of the butter, although it increased its weight; and these, though made before the experiments detailed above, shall now be indicated, as

Series 7.

The cream of six English pints of milk was separated by a siphon, and churned in a glass vessel. The butter was formed in about half an hour; but the churning was continued for half an hour longer, when the butter had lost its fine, yellowish, waxy appearance, and had become pale and soft, while very little liquid remained in the churn. This butter was so soft that it could not be washed and worked, until it had remained some hours in cold water. It was pale, still rather soft, and, when weighed, = 2566 grains. That this was beyond the due quantity of good butter, from such a quantity of cream, was apparent, when the comparative experiments on the same quantities of the same milk, but only churned till the butter was well formed, gave the following results:—

No. 1, The sweet cream, overchurned,	yielded	= 2566	grains.
No. 3, The acid cream duly churned,	"	= 2187.5	"
No. 3, The acid milk and its cream, do.	"	= 2397.5	"
No. 5, The scalded cream, do.	"	= 2671.	"

The butter of No. 1 tasted insipid, never became firm, and soon turned rancid. It was found to yield a very unusual quantity of both caseine and of watery fluid, which could only be separated by melting the butter.

Similar experiments were repeatedly made, the results of which shewed that overchurning is very injurious to the quality of the butter; but it adds considerably to the weight of the article; and it appears to be frequently practised in Lancashire, especially in manufacturing *fresh* butter for *immediate sale*.

It is a common opinion in Lancashire that considerably more butter is obtained by adding *hot water* to the churn than by using cold water. We had invariably found that the addition of a small quantity of cold water, especially in summer, greatly facilitated the separation of the butter, and rendered it more easily washed. But a dairyman informed us that the same quantity of cream, which will yield 14 lbs. of butter with *cold water*, will afford 15 lbs., or even 15½ lbs., with an equal addition of hot water. This formed the subject of

Series 8.

On the 15th of November, 1807, we took, from the mixed milk of four cows, two portions of six English pints each, and set them aside in a milkhouse, the temperature of which ranged from 59° to 52°. *On the 17th November*, the cream was removed from each by the siphon, and churned at the same, in circumstances as nearly equal as possible, except in the addition of water. The temperature of the cream, at the commencement of the churning, was 55°.

No. 1. To this portion an ounce and a half of water, at temperature 45°, was added. After churning for eighteen minutes, the butter began to appear; two ounces more of water, at 45°, were added, and the churning was carried on for five minutes more. The butter was then worked and washed.

No. 2. To this portion of cream one ounce and a half of water, at 105°, was added; butter began to appear after churning for thirteen minutes, when two ounces more of water, at 105°, were added, and the churning was continued for five minutes more, or eighteen minutes in all. The temperature of the contents of the churn was 71°. This butter was very soft, and, therefore, cold water was added, in which it was worked and washed.

Unfortunately, the note of the weight of the butter in this series has been lost; but I find it stated that the butter of No. 2 was rather more bulky, and weighed a little more than that of No. 1; that it neither was so firm nor of so rich a colour as the butter of No. 1; and that, on pressing it next day, some watery fluid escaped from it. From this we inferred that the quality of the butter was deteriorated by the addition of hot water; and that the quantity obtained by this practice, of marketable butter, is not so great as is commonly alleged in Lancashire, although the time of churning is thus somewhat abridged.

[From the Albany Daily Advertiser.]

NOTICES OF THE WINTERS AT NEW YORK FOR THE LAST FORTY-TWO YEARS, AND OF THE DATES AT WHICH THE HUDSON WAS FROZEN OR WAS OBSTRUCTED OR CLOSED BY ICE AT ALBANY.

1789—1790. A very mild winter. The mildest January since 1781. River open till 3d February, though occasionally obstructed by ice before.

1790—1791. Very severe weather in December, but more moderate in January and February. River closed on the 8th December. Lowest degree of thermometer, this winter, 5° above zero.

1791—1792. A very severe winter. River closed on 9th December; uninterrupted and severe frost for four weeks; lowest degree of thermometer, 1° above zero.

1792—1793. A very mild winter; river open all winter to Poughkeepsie; though it closed at Albany on the 12th December.

1793—1794. A mild winter with but little snow; river closed on 26th December.

1794—1795. A very mild autumn and December; river closed on the 12th January; no ice till 3d January, and but little cold weather and snow this winter.

1795—1796. Another very mild autumn and December; no ice till 21st December; river open till 23d January.

1796—1797. Early winter and severe till 12th January; river closed on 28th November, intensely cold on 23d and 24th December; mercury at zero in the morning.

1797—1798. Very early and severe winter; river closed on 20th November; lowest degree, 3° above zero.

1798—1799. Very early, long and severe winter; though the weather was moderate for about three weeks in January; river closed on 23d November; lowest degree, 2° above zero.

1799—1800. A mild winter; river closed on 6th January, but obstructed by ice before.

1800—1801. A mild winter, with but little snow; a very mild December, river closed on 3d January.

1801—1802. A remarkably mild winter; river open till 3d February, though obstructed by ice occasionally before. In January the mercury generally ranged between forty and fifty degrees, and no snow of any consequence fell till 22d February.

1802—1803. A mild and variable winter with but little snow; river closed on 16th December.

1803—1804. A very mild December; some severe weather and deep snows in January and the latter part of February; river open till 12th January; lowest degree, 42° above zero.

1804—1805. A remarkably cold and variable winter, deep snows and heavy rains with high winds; lowest degree, 2° above zero; river closed on 13th December—much distress among the poor.

1805—1806. Generally cold in January, though very mild in December and February; river closed 9th January, and opened on 23d February.

1806—1807. A severe winter; river closed on 11th December; lowest degree, 4° above zero.

1807—1808. A mild winter; December very mild; river closed on 4th January.

1808—1809. A long and severe winter, with much snow; river closed on 9th December; lowest degree, 6° above zero.

1809—1810. Remarkably mild till 19th January, when the river closed, and the weather was intensely cold for several days; very little snow this winter; lowest degree, 1° above zero.

1810—1811. Much snow in February, though not much severe cold this winter. This season was remarkable for a severe snow storm on the 2d November; river closed on the 14th December.

1811—1812. A severe winter; river closed on 20th December; lowest degree, 2° above zero

1812—1813. A severe winter; river closed on 21st December; lowest degree, 4° above zero.

1813—1814. A severe winter; river closed on 22d December; lowest degree, 8° above zero.

1814—1815. A very severe though variable winter; river closed on 10th December; lowest degree, 1° above zero.

1815—1816. A variable though not severe winter; river closed on the 2d December.

1816—1817. A very severe winter, though it did not set in till the middle of January; river closed on 16th December, thermometer on 15th February was 6° below zero, and the first time since 1788 that it has fallen below zero in this city. As cold as in January, 1765, when the mercury sunk to the same degree; which the papers state to have been the coldest weather experienced in this city in fifty years.

1817—1818. Generally moderate in December and January, though severe in February; river closed on 7th December, opened on 14th, and closed again on 21st December; mercury fell to zero this winter.

1818—1819. Severe weather for two weeks in December; river closed on the 14th; generally very mild in January and February.

1819—1820. A severe winter; several deep snows; river closed on 13th December, though obstructed by ice before; lowest degree, 3° above zero.

1820—1821. Intensely severe weather during the greater part of January, though mild in February; river closed on the 13th November, opened on 20th and closed again on 1st December; the mercury fell on 25th January, to 7° below zero, one degree lower than in February, 1817; as cold weather, probably, as was ever experienced here. The Hudson was crossed on the ice between this city and Powles' Hook, for several days. During the last hundred years, the river has been passable on the ice, in the same way, only four times, viz: in 1740-41, 1764-65, 1779-80, 1820-21.

1821—1822. A severe winter with but little snow; river closed on 13th December; mercury as low as one degree below zero.

1822—1823. No very severe weather till February and March; river closed on 24th December; lowest degree, 3° above zero.

1823—1824. Very mild winter; river closed on 16th December; open in January for a short time.

1824—1825. Mild winter with but little snow; river closed on 3d January.

1825—1826. Weather generally very mild, though there were two or three excessively cold days this winter. December 14th was a remarkably cold day; thermometer, at 8 A. M., 3°, and 10 P. M. indicated 2°, 7° and 9°; river closed on 13th December.

1826—1827. A severe winter; river closed on 24th December; lowest degree, 3° above zero.

1827—1828. A very cold and blustering November, followed by the mildest winter since 1801-2; river closed only about three weeks at different times through the winter. The mildest February since 1778-9, when vegetation commenced, and flowers were gathered in the woods, and in Pennsylvania, peach trees blossomed in this month.

1828—1829. A long, severe winter; river closed on 1st January, and opened on 29th March; lowest degree, 6½° below zero. Much suffering among the poor in February.

1829—1830. Weather generally mild, till 23d January, when the river closed; weather then very severe for several weeks. As much ice in our harbor as in 1826–7; lowest degree, 3° above zero.

1830—1831. A very severe winter, with several deep snows; ground covered with snow from 6th January to the 28th February, a longer period than in any winter since 1808–9. Severe and uninterrupted frost for upwards of five weeks; during which time, there was but three days in which the mercury rose as high as the freezing point; lowest degree, 5° above zero. Much distress among the poor. River closed on 23d December, opened again by heavy rains, and closed again on 16th January.

1831. December 10th: thus far the coldest December since 1786; lowest degree, 14° above zero; river closed on 3d December.

[From the Baltimore Sun.]

COLD WINTERS AND DEEP SNOWS.

The recent heavy snow storms experienced both east and west of the mountains, have had the effect to bring out, in several newspapers, some cold weather reminiscences. The United States Gazette has accounts from 1681 to 1840, of cold weather at and in the neighborhood of Philadelphia. We take a few of the instances given. In December, 1704, snow fell to the depth of three feet. In 1725, it fell in one night to the depth of two feet. The winter of 1737, was intensely cold; many persons were frozen to death. The winter of 1751, was so cold that many cattle and deer were frozen to death; bread stuff and provision were so scarce and dear, that many persons in the country had to subsist on the deer found dead. As late as the 19th of April, the snow lay upon the ground to the depth of three feet. On the 9th of January, 1773, the mercury was 9° below 0. 1780 was a memorable cold winter; the ice in the Delaware was three feet thick; squirrels and partridges were found in the woods and fields frozen to death.

In the spring of 1789, fires were necessary until the first of June. The winter of 1790 was so mild and warm, that on the

2d of January, the boys went into the Delaware to bathe. The winter of 1797 was intensely cold. The mercury frequently sunk from 10° to 13° below 0. A gill of brandy was put into a saucer, and placed in an open lot north of the city, on the 9th of January, and a ring of ice formed round the edge an inch broad. A gill of water, placed near, froze solid in ten minutes. The winter of 1815 was very cold, and fuel scarce. Oak wood sold at from twelve to fourteen dollars a cord. The winter of 1821 was excessively cold. The mercury, several times, fell to 10° below zero. On the 24th of January, three cows froze to death near the city. The Cincinnati Republican, after alluding to the snow storm experienced there on the 4th, 5th and 6th of this month, as the most severe that had visited the south part of Ohio for several years, gives, from old files of papers and documents in the possession of the editor, some account of the great New-England snow storms of the last century. Among these, the tempest of 1717, known in history and tradition, as *The Great Snow*, is mentioned. The weather was mild until the beginning of February; but on the 18th of that month, the storm commenced, and continued, with short intervals, for nearly a week. The northeast wind, in fierce gusts, drove the descending snow into drifts that obliterated the roads, covered the fences, and in some places, even the buildings.

In Boston, the snow lay in the street six feet deep. Multitudes of animals perished in the drifts. A letter from John Winthrop, of New-London, to Cotton Mather, says :- "We lost at the island and farms, about 1100 sheep, besides some cattle and horses interred in the snow; and it was very strange, that eight days after the storm, the tenants at Fisher's Island, pulled out of the ruins, 100 sheep, out of one snow bank in a valley, where the snow had drifted on them sixteen feet, and found three of them alive in the drift, which had lain on them all that time, and kept themselves alive by eating the wool off the others, that lay dead by them. As soon as they were taken out of the drift, they shed their own fleeces, and are now alive and fat." The winter of 1741 was intensely cold. Deer were found dead in the woods, and some even ventured to the farmers' houses and fed on hay with the cattle. In January, 1780, wood sold in the village of Worcester, Massachusetts, at sixty dollars a cord. The roads were so blocked up with snow, that no fuel could be brought from the forest. The snow was four feet and a half deep in the woods on a level. Fences and low buildings were buried beneath the drifts; and the inhabitants of contiguous houses, reached each other through arches hollowed under the snow banks. The sufferings of the people of New-England, especially in the small villages, were very great.

AMERICAN AGRICULTURAL ASSOCIATION, NEW-YORK.

A few weeks ago we alluded to the importance of establishing an agricultural association in this city independent of every other organization and specially devoted to the improvement of agricultural science. Such a society has just been organized, with the following officers :

President.—Hon. Luther Bradish.

Vice Presidents.—Hon. Theodore Freylinghuysen, James Lennox, Esq., James Boorman, Esq., A. H. Stevens, M. D., Thomas A. Emmet, Esq., Hugh Maxwell, Esq., Stephen Whitney, Esq., Stephen Knapp, Esq., Vice-Chancellor McCoun, Cyrus Mason, D. D., W. A. Seeley, Esq., J. S. Livingston, Esq.

Honorary Consulting Officers.—Major Le Conte, U. S. A., F. L. S., *Entomology and Zoology.* Professor Renwick, LL. D., *Mechanical Philosophy.* W. G. Redfield, Esq., *Geology.* Professor Torrey, M. D., *Physiology.* John Johnson, Esq., *Rural Architecture.* Professor Loomis, *Meteorology.* D. P. Gardner, M. D., *Chemistry.* D. J. Browne, Esq., *Arboriculture.*

There was a large and spirited meeting of this association—the fourth that has been held since its formation for the despatch of business—in the Library of the Historical Society. Seven o'clock was the hour named for commencing the proceedings ; but as at that hour the greater number of those who attended had not arrived, a delay of more than half an hour took place. At length

The Hon. Luther Bradish called the meeting to order, and, after inviting all those gentlemen who had accepted their nominations to offices to be seated at the table, said :—

Gentlemen : On entering upon the discharge of the duties you have been pleased to assign me, I cannot refrain from offering you, and the friends of agriculture generally, my cordial congratulations, as well upon the numbers, as the character of those who compose this meeting. This indicates a concern of the right kind which exists for the great interest of our country—that of agriculture. As the cultivation of the earth was the original, so it was, and is still, the most general, the most important, and the noblest occupation of man. To improve this great interest—to introduce into its practical operation all the discoveries and improvements in science—thereby improving and beautifying this earth of ours, and increasing all the necessaries, the comforts, the embellishments of life ; these are objects worthy of the attention and efforts of every friend of his country and his kind ; these are

the objects of the American Agricultural Association; these are objects this society propose to pursue, with reference to the present state of scientific knowledge and actual condition of the world. Among the remarkable characteristics of the age in which we live, there are two prominent ones; first, the great developments in natural science—and, secondly, the application of these new discoveries to the practical business of life, and the great interests of society. Scientific knowledge is not now what it once was. It is no longer confined within the magic and mystic circle within which it was deemed forbidden for all but the initiated to enter. It no longer dwells within the college or the schools, but it has come forth among the people, mingles in the affairs of the world, and directs its practical operations. Principles are no longer valued merely because they are ingenious, or adapted to lend brilliancy to some theory, but they are valued as of practical utility, and as they subserve the great interests of mankind. Ours is eminently a utilitarian age. Now, what the American Agricultural Society proposes, is, to follow this manifest spirit of the age, and introduce into agriculture, as far as is practicable and may be useful, the discoveries and improvements of modern science. Indeed, we hold the opinion that no system of agriculture can be considered as enlightened but in proportion as it may prove useful. What, for example, would you think of a physician—I do not now speak of those geniuses who accomplish wonders by the force of instinct, who are not only equal with, but in advance of science—but I speak of those learned gentlemen who really cure disease. What would you think of the learned doctor who would prescribe for a disease without any knowledge of its character, its symptoms—or, without any acquaintance with the *materia medica*, from which he professes to derive his remedy? So it is with agriculture; without a knowledge of the elements of active agents in production—the qualities of the soil—and whether that soil contained all the properties necessary for that production; if not, what manures and composts are suitable for invigorating it, or restoring the different agents—without this knowledge, no system of agriculture can be enlightened or perfectly successful. In illustration, let me suppose a case:—A practical farmer wishes to produce a certain crop from a particular field under cultivation. Now, if he knows what agents are necessary for the production of such a crop, and also that his field is deficient in any of those agents, he ought to supply them, and thus render the power of his soil complete. But without this knowledge, the usual error is to manure generally, by which, if the farmer has supplied the deficient agency, he may have added others in which the soil abounded. In this case he will obtain his crop, but it generally happens that those necessary agents are not supplied—in which case, he will not only have failed in his crop, but be subjected to additional expense. Now

the great object of the improved system of agriculture, is not merely to enable the farmer to produce more, for that he may learn from the fancy cultivator, with his expenses, appliances, and carelessness of economy—but to enable him to produce, and by that production to make money. That system of agriculture, therefore, is best, which enables the farmer, on a given amount of capital, to produce the greatest amount of profit. Profit, then, in agriculture, is the grand test of perfection; and these objects the American Agricultural Society propose, not only most fully, but only to obtain by the union of scientific knowledge with good productive husbandry. To ensure this union, and its legitimate results, is the great object of this association. But I may here be asked, perhaps, where is the necessity of a new agricultural Association? Have we not already sufficient number of institutions for the promotion of this object? Have we not, even in our midst, the American Institute with its agricultural department? In answer to this I would remark here, in the first place, that, as regards the American Institute, I never can, here or elsewhere, speak of that noble and patriotic institution but in terms of the warmest respect and regard; and as a citizen of the United States, I am happy to avail myself of this occasion to express my acknowledgments for the great good they have already accomplished, and, I trust, the greater good they are yet destined to achieve. But with objects so numerous and extended, the American Institute cannot give agriculture that attention it demands. Mr. Bradish concluded in a few words, illustrative of the wide field there was for the co-operation of their new association to promote the end proposed.

Mr. Meigs returned thanks for the complimentary allusion of the President, to the American Institute, and expressed himself delighted to see the formation of the new Association in a cause dear to him and all true friends of the country; after which,

The Secretary read the minutes of the last meeting, held on January 22d, which were adopted.

A report from the Visiting Committee having been read, another of a more important character, from the Executive Committee, was introduced by the Secretary. Accompanying the report, was a draft of the constitution and by-laws of the Association, which the Executive Committee submitted for the approval of the meeting. They were unanimously adopted, after a few alterations suggested by Professor Mason and Dr. Stevens, one of which made the President and Secretaries ex-officio members of the Executive Committee, to which the constitution assigned the power of disposing of the unappropriated funds of the Society.

W. A. Seeley, Esq. read an admirable and elaborate paper to the Society upon Organic and Agricultural Chemistry, in which

the importance of science to agriculture was shown in a masterly manner—it elicited warm marks of approval.

The meeting was then addressed by Dr. Stevens, Dr. Underhill, and Professor Mason, when the thanks of the Association were voted to the Historical Society for the gratuitous use of their rooms; and the meeting adjourned till the first Monday of next month.

PERUVIAN AND AFRICAN GUANO.

"*Resolved*, That the Association cause an analysis to be made of the cargoes of guano from Ichaboe and Peru, now in the market, for the use of members and all persons in the neighborhood; and that a report be drawn up with the analysis, containing suggestions for the application of the manure; the whole to be published as early as practicable in the agricultural papers of this city and vicinity."

PERUVIAN GUANO.

Uric acid	10.5
Ammonia	19.0
Phosphoric acid	14.0
Lime and magnesia	16.0
Salts of soda and potash	6.0
Oxalic acid, with carbonic and muriatic acids	13.0
Water	13.0
Sand	2.0
Volatile and organic matters	6.5
	100.00

ICHABOE GUANO.

Ammonia	13.5
Humic acid	4.0
Phosphates	25.0
Oxalic, &c., acids	20.0
Salts of Soda, &c	7.0
Water and volatile matter	27.5
Sand	3.0
	100.00

Prices and Relative Value of the Peruvian and African Guano.—These specimens are both very fair, and represent the peculiarities of the two kinds of guano. The absence of uric acid in the African variety, is the cause of its inferiority; for that body decaying gradually in the soil, continues to yield carbonate of ammonia for a long time, so that the stimulating effects of the guano are seen the next year, whilst the African is more fleeting. The prices of the two are, for Peruvian $45, and for African $35

per ton, for quantities amounting to five tons; and this may be considered, all things being taken into account, a fair representation of their value in agriculture.

The African being soluble to the extent of 40 per cent, is better adapted for watering plants, and where very rapid growth is wanted. The Peruvian, on the other hand, acts for a longer time, and is better calculated for crops which continue to grow vigorously during many weeks. The two will probably produce very similar effects for one crop; but the Peruvian is much more active on the second crop.

Crops to which it is Applied.—It is hardly necessary to state, that the application may be made to every crop, for experiments are already multiplied with nearly every common plant or tree: to enumerate a few is sufficient. Wheat, corn, grass, the cerealia, sugar-cane, tobacco, apple, pear, and other fruit trees, flowers, cabbages, turnips, and other cruciferous plants; the experiments are fewest on leguminous plants. But the effect of guano will not be equal on all; for those plants requiring most stable manure, such as tobacco, turnips, and corn, are more benefited than grass, oats, or such as require less—the chief effect of the manure being due to the quantity of the ammonia it contains. The reason guano is serviceable to all plants, arises from its containing every saline and organic matter they require as food.

Kinds of Soil to which it may be Applied.—It has been used beneficially on all soils; for as it contains every element necessary to plants, it is independent of the quality of the soil—*one great point* being attended to, that the land be in *good tilth*; for, otherwise, the tender roots of the vegetable find an obstruction to free growth, and are crippled. Poor, well-tilled soils exhibit most increase by guano, for in them, some essential to the growth of plants is more likely to be absent.

Amount to be Applied.—On wheat, 250 lbs. per acre will be an average for a fair soil; 300 lbs. per acre for one that is poor, and 200 for a good soil. Corn, potatoes, turnips, cabbages, and garden vegetables, will require 300 lbs. in fair lands; but the amount may be dimished by 50 lbs., if two applications are made instead of one. For grass, rye, and oats, 200 lbs. will be enough.

Time and Mode of Application.—Seeds may be prepared by soaking in a solution of two lbs. of guano to the gallon of water, and this will answer for a first manuring, if they are left sufficiently long to exhibit signs of germination. Wheat and other small grains should be steeped in this solution about sixty hours, corn about one hundred hours. Thus steeped, the seeds of smut will also be destroyed. Half the quantity per acre to be applied when the plant has fairly started, and is in second leaf. By this timely addition, the effects of many insects are avoided, and the seedling at once takes on a robust habit. The remaining half should be ap-

plied to the small grain crops when they are throwing out new stems, or tillering; to corn, as the tassel appears, or at the second hoeing, and so with other hoed crops. This application should be made, therefore, at the latest period of working, and as nearly before flowering as practicable. The guano should be sowed with a mixture of fine soil, gypsum or charcoal, to give it bulk, and divide the particles. No lumps should be thrown amongst the plants, for they burn them; and where an extensive application is to be made, it is better to screen the manure and pound the lumps. In sowing, reach the soil, if possible, for it is unserviceable to sprinkle it on the plants, and frequently destroys them. Select a season when the land is wet or moist, or when rain may be expected; for in dry weather the guano does not answer well, or even does injury, by acting as a caustic on vegetation. But if the crop suits, always prefer manuring the plant or hill; do this whilst hoeing; less guano is thus used, and more certain effects result. One tablespoonful to the hill of corn, tobacco, potatoes, &c., is an abundance for each application. If a solution be preferred, mix one pound in ten gallons of water, and water sparingly with this on the soil, and not *on the plants*, at the times before mentioned, taking care to stir up the insoluble portion when applied. For this purpose, the African variety will be most suitable. Or, where rapid growth is wanted, irrespective of seed, the clear solution may be applied; the insoluble matter (phosphates, &c.) being reserved for wheat and corn. Guano may be composted with common soil, or anything but *lime* and *unleached ashes*; for these liberate the free ammonia, and thus diminish the effects of the manure.

Value, compared with other Manures.—So far as the experiments in England and Scotland may be adduced, one cwt. of guano is equal to about five tons of farm-yard manure on an average; but it is much higher for turnips than for grass, &c. It would be advisable that in the very different climate of the United States, comparative experiments be made on this point. Let twenty single cart loads of stable manure be used per acre on wheat, corn, &c., and contrasted with four cwt. of guano. It would also be of service to the agricultural world, that some experiments were made on the value of the organic and inorganic portions of guano. A plot of ground, eight square yards, may be divided into two parts, one half manured with the ordinary guano, and half with the ashes remaining after burning. In this way, the proportionate effect of the organic and saline parts would be estimated, and the conclusion be serviceable, insomuch as the saline matters can be mixed into a compost for a trifling sum, and thus the expense of guano avoided. D. P. GARDNER, M. D.

Notice.—This publication is made by the American Agricultural Association, not that parties may be induced to purchase guano,

but that attention may be called to the varieties for sale, and other particulars, for the diffusion of correct information. It is their intention to examine all available manures, and make them known publicly, as well as the results of careful experiments in agriculture, horticulture, and the management of stock, and to issue not only information from time to time, but a series of Transactions, embodying the particulars of their experiments, analyses, &c. All those wishing to advance the cause of improvement are respectfully solicited to become members, and forward suggestions for the advancement of agriculture. Letters or communications to be addressed, post-paid, to the Secretary of the Executive Committee, Dr. D. P. Gardner, 412 Fourth-street, New-York. By order of the Executive Committee.

R. L. Pell, *Chairman*.

March 12, 1845.

THE ALPACA.

We desire to direct the attention of our wealthy farmers to the following extract, from the British Cultivator. It will be seen, on its perusal, how much interest this animal is exciting in England and Scotland; and, may we not hope that an equal amount of interest may be excited also in this country, especially in the state of New-York. Probably there is no climate, nor any range of country better fitted to the natural habits and wants of this animal, than the northern section of this state. Mountainous and broken, as much of it is, and yet producing a great abundance of the food which is adapted to the constitution of the Alpaca, and at the same time furnishing a most ample extent of country which is fitted only for grazing, it seems that a better combination of circumstances does not exist where such an enterprize as the introduction of this animal bids so fair for success.

"For most of our cultivated plants, and, indeed, for many of our domestic animals, we are indebted to other countries. With regard to the former, the history of their introduction is, in many cases, well established in detail; but it is so long since the latest of them—the potatoe, the turnip, or the mangel-wurzel, or carrot, for instance—was first cultivated in our country, that farmers have fairly settled down into the belief that they must make the best of the subjects they have on hand, for that Nature has nothing further in her stores suited, in our climate, for the wants of man or beast. And with regard to the latter, the introduction of the very latest dates so far back, that we must estimate the prejudice as stronger still, which scouts at the idea of any further addition being made to our stock of domestic animals from the lists of other coun-

tries. Of course, in speaking of this universal prejudice, we allude simply to the generality of those who at present occupy and cultivate our soil, and who form their opinion, probably, without very well knowing the grounds upon which it rests.

There is every probability, notwithstanding the general notion to the contrary, that a useful addition will shortly be made to our stock of domestic animals. The alpaca, from the experience of it which has been compiled from various quarters in this country by Mr. Walton, really seems likely hereafter to play an important part in the stock-farming of the hilly districts of the kingdom. This animal is indigenous in the mountainous regions of Peru, where two domesticated species of it occur. The one receiving the name of llama, is used as a beast of burden; the other, the alpaca, to which we at present allude, is a wool-bearing animal, and of it large flocks were formerly possessed by the Incas, sovereigns in former days of that country, and by other wealthy inhabitants of it. The climate of the districts in which this animal flourishes, is described by Mr. Walton as follows:

'The woolly natives possess a hardiness of constitution, and a peculiarity of structure, admirably well adapted to the nature of their birthplace. There, during half the year, snow and hail fall incessantly; whilst in the higher regions, as before noticed, nearly every night the thermometer falls below the freezing point, and the peaks, consequently, are constantly covered with an accumulation of ice. The wet season succeeds,' &c.

On the applicability of the alpaca to our soil and circumstances, we quote the following remarks:

'The hardy nature and contented disposition of the alpaca cause it to adapt itself to almost any soil or situation, provided the heat is not oppressive, and the air is pure. The best proof of its hardiness is its power to endure cold, damp, hunger, and thirst—vicissitudes to which it is constantly exposed on its native mountains; while its gentle and docile qualities are evinced in its general habits of affection towards its keeper. No animal in the creation is less affected by the changes of climate and food, nor is there any one to be found more easily domiciliated than this. It fares well while feeding below the snowy mantle which envelops the summits, and for several months in the year clothes the sides of the Andes. It ascends the rugged and rarely trodden mountain path, with perfect safety; sometimes climbing the slippery crag in search of food, and at others instinctively seeking it on the heath, or in rocky dells shattered by the wintry storm; at the same time that, when descending, it habituates itself to the wet and dreary ranges on the lowlands, so long as it is not exposed to the intense rays of the sun.

'Many of our northern hills would try the constitution of any

sheep, and yet there the weather is never so inclement or so variable as on the Cordilleras of Peru. With so many advantages, why then, shall not the alpaca have an opportunity of competing with the black faced sheep, the only breed that can exist in those wild and inhospitable lands? Of the two, the stranger would fare best on scanty and scattered food; at the same time affording to the owner a far better remuneration.'

The alpaca wool is at present used largely in British manufactures. Mr. Walton estimates the quantity hitherto consumed, since its introduction in 1832, at 12,000,000 lbs. The price of it varies from 1*s*. 8*d*. to 2*s*. 6*d*. per pound, and the average weight of the fleece may be put at 10 pounds. Were the animal fairly naturalized on some of our bleakest hill districts, such land would soon increase in value from the increased worth of its annual produce in alpaca wool. And it appears from the experience of several gentlemen who have small flocks, that, when its habits shall be thorougly understood, little difficulty will be experienced in doing so. The following is a statement by Mr. Stirling, of Craigbarnet place, Lennoxtown, Glasgow, a gentleman better qualified to speak on the subject than any one we could name:

'I can have no doubt that, when the subject is better understood, the animal itself better known, and a more expeditious method contrived to bring them to Britain, we shall have thousands of them. When known, their docility, their temperate habits, their hardiness, and, I may add, their easy keep, will, ere long, bring them into general notice. I can answer without the fear of being contradicted, that they will thrive and breed in Scotland equal, if not superior to our native black faced sheep.'

To those who would laugh at the idea of bringing over here, and domesticating on our hills, a Peruvian camel or sheep, (for the alpaca has properties in common with both,) we would point to Australia, a country which not many years ago possessed no quadruped but the kangaroo; and yet notwithstanding its many peculiarities of climate, is now thickly peopled with our sheep and oxen. But the question must not be left to generalities of this kind. The experience of a few short years, on the larger scale whcih expected importations will enable, will determine it satisfactorily; and if, as in all probability will be the case, the alpaca should become one of our domestic animals, the best thanks of the country will be due to Mr. Walton for the persevering energy with which he has pressed the subject on public attention. His book is an exceedingly interesting and neatly got-up little volume, and will, we doubt not, prove a useful publication."

ON THE FORMATION OR SECRETION OF CARBON BY ANIMALS.*

BY MR. ROBERT RIGG.

The scientific world is at present much occupied with the application of chemistry to animal and vegetable physiology; and it may be interesting to some of your readers to know, that by a few very simple experiments they may satisfy themselves upon that branch of the subject which relates to the formation of carbon by animals.

Suppose an animal, which comprises in its whole system 50 parts by weight of carbon, to be kept for five days, during which it consumes other 50 parts, it is evident that if during the five days it gives to the atmosphere 60 parts, and at the end of that time it is found to have increased its weight of carbon by 10 parts, there is a positive gain of carbon equivalent to 20 per cent.

The experiment may easily be made upon young small animals. Take two of these so nearly alike that there can be no material difference in the weight of the carbon they comprise. Kill one of these, and expose it to a temperature not exceeding 220°, for two or three days; it may then be powdered, and by subjecting an average sample to analysis with oxide of copper, the weight of carbon comprised in the entire animal may be determined with the greatest certainty. The other being supplied with food, the weight and chemical constitution of which is ascertained, should be kept in a limited atmosphere, which must be tested and changed every one, two, or three hours,† the increased proportion of carbonic acid of that atmosphere will show the quantity of carbon given off by the animal in the course of the experiment; and the increase or decrease of carbon in the animal itself may be ascertained in the manner above mentioned.

In this manner I have experimented upon many animals; and without taking account of the carbon which passes off otherwise than by respiration, the result has invariably been a great increase of carbon—an increase which cannot be accounted for, unless we conclude that carbon is secreted by animals.

Amongst my best experiments, are those made with young mice. A healthy young mouse, weighing 200 grains, comprises in its constitution from 25 to 30 grains of carbon; when fed daily with 60 grains of bread moistened with water, containing about 16 grains of carbon, it increases in weight, and imparts to the atmosphere from 20 to 26 grains of carbon, the quantity varying gene-

* *Medical Gazette*, Aug. 23, 1844.

† The health of animals appears to be affected by an atmosphere containing more than 5 per cent. of its volume of carbonic acid.

rally with the quietness or the habits of the animal. A kitten, from six to ten weeks old, when supplied daily with four fluid ounces of skim-milk, containing 66 grains of carbon, will increase in weight, and impart to the atmosphere from 80 to 110 grains of carbon.

Either of these two animals may be kept without food until they give off by respiration a weight of carbon equal to 80 per cent, and retain from 60 to 70 per cent., of that which they comprised at the commencement, showing that a weight of carbon equal to 40 per cent, had been secreted. The experiment may also be made with birds supplied with little or no food. A tomtit was placed under experiment without food; the bird was violent and restless during its imprisonment. In sixteen hours it imparted to the atmosphere 65 per cent. of carbon, when it appeared to die of exhaustion, and retained 77 per cent of the weight of carbon it originally contained; showing a secretion of carbon in sixteen hours, when under violent exertion, equal to 42 per cent.

On making the carbon in the food, and that in the air respired by a full grown person, the basis of our calculation, we obtain results which favor the conclusion that carbon is likewise secreted by man. Physiologists estimate the weight of carbon in the air respired by an adult at from 5,000 to 6,000 grains per diem. I have subjected to analysis many articles of food, and found this weight of carbon far to exceed that in the food consumed by most laboring men, who may be supposed to impart to the atmosphere the greatest weight of carbon. A person eating each day after the following rate, will consume 6,000 grains of carbon:

Rump steaks	1	lb.	containing	1,050	gr. carbon.
Bread......	1½	do.	"	2,830	"
Potatoes....	½	do.	"	310	"
Porter.....	2	pts.	"	760	"
New milk..	2	fl. oz.	"	57	"
Butter.....	½	oz.	"	320	"
Cheese....	1	do.	"	150	"
Sugar.....	2	do.	"	350	"
Coffee.....	1	do.	"	96	"
Tea.......	1	do.	"	80	"
				6,003	

This weight of carbon is not more than is consumed by some persons who are actively employed, but it far exceeds that in the food of our laboring population; and on comparing it with that allowed for each adult in the different workhouses, &c., we have in the dietary of the—

	Per Cent. of this 6,000.
City of London Union..........................	75
Brentford do.	50

		Per Cent. of this 6,000.
Uxbridge	do.	55
Aylesford	do.	56
Macclesfield	do.	44
Westminster New Prison		57
Milbank Penitentiary		80
House of Correction, Clerkenwell		53
Hanwell Lunatic Asylum		75

And if we make the carbon in the food of some of our agricultural laborers the subject of comparison, we find the deficiency greater than in any of the above mentioned dietaries.

I could add to these many other experiments, which furnish, in my opinion, irresistible evidence of the secretion of carbon by animals. If an animal be kept without change of circumstances, or of diet, except as to the quantity of food, it will be found that the weight of carbon in the air respired, does not vary in proportion to that consumed in the shape of food. On the contrary, the deficiency of carbon supplied seems to be met by an extraordinary effort of the animal system, as appears from the following results of accurate observation :—

	In the food.		In the air respired.
If an animal in the first 24 hours has a plentiful supply of food, there is	80	grs. of carbon	100
In the next 24 hours a less quantity	70	"	94
" " a sparing do.	60	"	87
" " a small do.	50	"	78
" " a very small do	40	"	65

But if the animal, instead of having its quantity of food varied, should be sometimes left in a quiescent state, and sometimes excited to great activity, the weight of carbon given off will be found to vary in proportion, within certain limits, to the activity of the habits of the animal, and the exertion called forth.

If the carbon in the food be represented by	100
That given off by an animal of easy habits will be	110
That given off by an animal of active habits, will be	130
Do. do. when under exertion	140
Do. when under great exertion	150

If the animal be both stinted of food, and excited to great activity, the difference between the carbon comprised in the food and that given off by the animal is as follows :

	In the food.	Given off.	Difference.
Carbon	100	120	20
"	80	105	25
"	60	90	30
"	50	85	35

Hence food is a substitute for expenditure of animal strength. To this may be added, that when an animal is distressingly exercised, the weight of carbon in the carbonic acid given off by respiration is at first increased, afterwards gradually diminishes, and becomes much less when the animal is in a state of exhaustion. Rest alone is not then sufficient, but rest and food soon restore the strength of the animal; and with its strength its power of secreting carbon—a power which I conceive to be essential to animal life, and which will probably furnish a solution to some of the most difficult problems of animal physiology, including that of the generation of animal heat.

[From the Glasgow Argus.]

DINNER IN HONOR OF PROF. LIEBIG.

We doubt not that many of our readers will be pleased with the remarks of Prof. Gregory at the Glasgow dinner, in October last. They give a succinct view of the labors of this distinguished man, and the contributions he has made to science. For this reason, they are deserving of a place in our columns. It is true, that this speech contains a few words which may not be intelligible to all our readers; still, by far the greater part is, and may be presented with profit and pleasure.

"Professor Gregory, on risng, was loudly applauded. My Lord and Gentlemen, he said, in proposing, as I have been requested to do, 'The Progress of Organic Chemistry,' I may perhaps be allowed briefly to direct your attention to its recent history, more especially in connection with the name of our honored guest. (Cheers.) Before his time, the analysis of animal and vegetable bodies was a most tedious and difficult operation. By his improvements, and especially by his admirable invention of the potash apparatus for determining the proportion of carbon, he rendered organic analysis so easy and so sure, that the chemist can now undertake, and complete in a few weeks, researches which would formerly have demanded years of labor. (Cheers.) A glance at the former and at the present state of organic chemistry would give the best idea of the value of Liebig's improvements; and it ought to be specially noticed, that, although his methods have been now and then objected to, they are at this day, universally employed by chemists. (Applause.) Armed with the powerful weapon of a sure and easy method of research, Liebig, in 1822, took the field in organic chemistry; and the trophies of his prowess are seen in an uninterrupted series of the most splendid original

researches in that department, from that date to the present time. Permit me briefly to allude to the more important of these, confining myself, however, chiefly to the subject of general organic chemistry. The services which Liebig has rendered to agricultural and physiological chemistry will, I doubt not, receive due attention from other speakers. The researches of Liebig, then, embrace, among numerous original discoveries of new compounds, those of hippuric, onauthic, and amygdalmic acids; of chloral and aldehyde; of melon, melane, and a host of allied compounds, including two artificial alkalies, melamine and ammeline; and in connection with his illustrious fellow-laborer, Wohler, that of the wonderful and interesting series of compounds derived from uric acid. In addition, however, to his actual discoveries of new compounds, Liebig has made vast contributions to our knowledge of those previously described. Thus, he has studied with the most brilliant success, all the important organic acids, as well as the interesting class of organic alkalies; he has developed the true nature of alcohol and of ether, and of the important process of acetification, or the making of vinegar; he has given us much new and valuable information on the different kinds of sugar; he has done more than any other chemist to extend our knowledge of the compounds of cyanogen; and has cleared up the theory of the very important manufacture of prussiate of potash, and placed this branch of industry on a much improved and secure foundation. Along with Wohler, he has, I might almost say, exhausted the extensive subject of uric acid; he has clearly developed the nature and relations of these three isomeric bodies—cyanic, fulminic, and cyanuric acids; and, by the demonstration of the existence and chemical relations of benzoyle, established the doctrine of compound radicals, the most valuable and fruitful additions yet made to the theory of organic chemistry. This may appear, to many of those whom I address, merely a catalogue of names, but the chemist will fully appreciate their value; he will remember that there is not one of the discoveries I have enumerated which has not exerted a beneficial influence on the progress of science, and that in them is often to be found the germ of those beautiful ideas, the successful application of which to practical purposes, in agriculture and physiology, has made us feel it a duty to assemble here this day, in order to express our admiration and our gratitude. But the labors of our valued guest have led to many other practical improvements; as, for example, in the preparation of drying oil for the painter; in the manufacture of vinegar, of prussiate of potash, of soap, of beer, and, what I am sure you will rejoice to hear, of wine; in the preparation of lactic malic, and formic acids, with many others; not to speak here of the immense benefit which agriculture and physiology are daily deriving from the application of his views. In organic chemistry,

the name of Liebig is, moreover, associated with several of the most important theoretical speculations, among which may be mentioned the now prevalent views, originally started by the sagacious genius of Humphrey Davy, of the true nature of acids and of salts; according to which, acids, instead of being, as Lavoisier supposed, invariably compounds of oxygen, are rather compounds of hydrogen, the latter element being the true acidifying principle; while salts are compounds in which the hydrogen of the acids has been replaced by metals. The doctrine of polybasic acids, that is, of acids requiring more than one equivalent of alkali to neutralize them, and the neutralizing power of which is measured by the proportion of replaceable hydrogen they contain, owes its development entirely to Liebig; and the same may be said of his profound and beautiful views on the process of fermentation, putrefaction, and decay. Were I asked to point out a good example of Liebig's researches, without particular reference to agriculture, I would select, out of many equally valuable, his researches on aldehyde and on the origin of acetic acid. We all know that no fermented alcoholic liquor can be produced except from the vinous fermentation of sugar; and also that all fermented liquors, under certain circumstances, are changed into vinegar, or, in common language, undergo the acetous fermentation; in more exact terms, the alcohol they contain is converted into acetic acid. Now, if we compare the composition of acetic acid with that of alcohol, we find that the former contains less hydrogen and more oxygen than the latter. It was therefore necessary to study the action of oxygen on alcohol; and Liebig, pursuing some observations of Doebereiner, soon found that this action constituted two stages. In the first, oxygen removes part of the hydrogen of the alcohol, forming with it water, and leaving aldehyde, a pungent volatile neutral liquid; and in the second, an additional quantity of oxygen combines with the aldehyde, converting it into acetic acid. This discovery at once cleared up the whole theory of the formation of vinegar from alcohol, put an end to the fancy of acetous fermentation, the process being one simply of oxidation; and, by detecting the source of loss in the process followed abroad for obtaining vinegar from brandy, (which was shown to be the escape of aldehyde unoxidised from a deficient supply of oxygen,) enabled the manufacturer to improve and economise his process. (Loud cheers.) But if I were called upon to select, out of the ideas suggested by Liebig in agricultural chemistry, those which do him the greatest honor, and which have added, and will add, most to our knowledge, I know not that I could do better than refer to his doctrine of the uses of the phosphates and of the alkalies in plants and animals. (Cheers. What is the use of the phosphates? of those substances which are never absent in a fertile soil: and which, accu-

mulated in the form of dung, of bones, or of guano, we restore to it as manure? We find them in the ashes of plants, but the question is, what purpose do they serve? A few years ago the mineral elements of plants were supposed to be accidental; but, by exact analysis of the ashes of the different parts of plants, Liebig discovered that the phosphates are invariably found in the largest proportion in the seeds; and, pursuing the investigation, he showed that the phosphates are essential to the existence of those vegetable products which are capable of contributing to the nutrition and growth of animals—of albumen, fibrine, and caseine; which bodies, as is well known, are chiefly found in seeds, but are present also, in all nutritious roots and juices. Hence he drew the conclusion that the phosphates are indispensable to the life of vegetables; not merely, as he showed, in being essential to the formation of seeds, but also for a wise and beneficent purpose, namely, that animals should find in the vegetables they consume, (such as grass, hay, oats, and turnips) albumen, fibrine, and caseine, the materials of which their blood, that is, their bodies, are formed. In animals, again, it is not merely their bones, but every part of their structure, that requires the continued supply of phosphates, while the phosphates not required for nutrition are discharged in the dung and urine, and in that form restored to the soil, again to contribute to vegetable life, and from plants again to pass into the bodies of animals. It is impossible to imagine a more beautiful display of the divine wisdom and power than is thus laid open to our view. (Cheers.) Again, what is the use of the alkalies which are always found in the ashes of plants, generally in the form of carbonates, indicating that they have been, in the fresh plant, combined with vegetable acids? The idea of Liebig is, that the alkalies, being supplied by the soil to the young plants, not by fixing carbonic acid from the atmosphere, which, along with the elements of water, under the combined influence of the vital force of the plant and the chemical agency of the alkali, passes first into oxalic acid, then into malic, citric, and tartaric acids, and finally, into sugar, gum, starch, and woody fibre, which have all essentially the same composition. Having served this important purpose, the alkalies, in the shape of vegetable ashes, or of animal manure, are again restored to the soil, again to run the same unceasing course of usefulness, and to excite our wonder and admiration of that infinite wisdom which has devised such beautiful arrangements for our benefit and happiness. (Cheers.) I cannot here refrain from mentioning, in proof of the continued activity of Liebig, that he published in May last a paper on the urine, which, for the importance of the subject, the sagacity displayed in its investigation, and the beauty, as well as the practical value of the deductions arrived at, is, in my opinion, entitled to the very highest place among all the modern writing on

physiological or medical chemistry. I earnestly recommend this invaluable paper, a translation of which has appeared in the *Lancet*, to the careful study of my medical brethren. The chemist will also be glad to learn that, still more recently, Liebig has published a most valuable memoir on mellon, confirming and extending his previous discoveries on that subject. It is not, however, only as the indefatigable investigator, the sagacious discoverer, or the profound philosopher, that Liebig has promoted the progress of organic chemistry. His sympathetic writings on the subject, especially his organic chemistry, written for the posthumous edition of *Greiger's Manual*, have greatly contributed to produce the present flourishing state of this branch of science. (Hear, hear.) The lectures on organic chemistry, now appearing in the *Lancet*, are still more interesting, as embodying his most recent views. I need say nothing of his two works on Agricultural and Animal Chemistry. These works are at least as well known and as highly appreciated here as in Germany; in fact, it is as the author of these works that we have met to do him honor; and it is pleasing to reflect that they have been so well received in Scotland. (Cheers.) But perhaps it is as the teacher that Liebig has done most. Look at the scientific journals of the last fifteen years, and you will find that three-fourths of the researches on organic chemistry which they contain have issued from the school of Giessen. Indeed, so valuable and extensive are the additions made to science by his pupils, working under his eyes, profiting by his advice, and enjoying, as all who have been there will bear witness, the most kind, liberal, and utterly unselfish encouragement on his part, that, even if we owed to him none of his great works, and none of the fine original papers he has given us, we should still be compelled to recognise in him, as a teacher, the greatest benefactor to organic chemistry, through the many distinguished chemists he has formed; a large proportion of whom are now Professors in all parts of Europe. Among the distinguished pupils of Liebig, Glasgow can claim a full share. The late Robert Campbell was a native of Glasgow, and the names of Dr. Robert D. Thomson, and of Dr. John Stenhouse, are now known throughout the scientific world. (Applause.) My Lord and Gentlemen—I have detained you far longer than I could have wished to do; but, as a pupil of Liebig's—as one who has, from an early period, devoted much attention to organic chemistry—above all, as one who has experienced, in its full measure, the unwearied kindness and the true friendliness of his nature—I could not well say less than I have done. I am sure you will join me in drinking, with deep gratitude to Justice Liebig—"Success to Organic Chemistry." The toast was drunk amidst great applause.

NEW METHOD OF OBTAINING CREAM FROM MILK: BY G. CARTER, OF NOTTINGHAM, LODGE NEAR ELTHAM, KENT.

A PECULIAR process of extracting cream from milk, by which a superior richness is produced in the cream, has long been known and practised in Devonshire; this produce of the daries of that county being well known to every one by the name of "clotted," or "clouted" cream. As there is no peculiarity in the milk from which this fluid is extracted, it has been frequently a matter of surprise that the process has not been adopted in other parts of the kingdom. A four-sided vessel is formed of zinc plates, twelve inches long, eight inches wide, and six inches deep, with a false bottom at one-half the depth. The only communication with the lower apartment is by the lip, through which it may be filled or emptied. Having first placed at the bottom of the upper apartment a plate of perforated zinc, the area of which is equal to that of the false bottom, a gallon (or any given quantity) of milk is poured (immediately when drawn from the cow) into it, and must remain there at rest for twelve hours. An equal quantity of boiling water must then be poured into the lower apartment, through the lip. It is then permitted to stand twelve hours more, (*i. e.* twenty-four hours altogether;) when the cream will be found perfect, and of such consistence that the whole may be lifted off by the finger and thumb. It is, however, more effectually removed by gently raising the plate of perforated zinc from the bottom, by the ringed handles, without remixing any part of it with the milk below. With this apparatus, I have instituted a series of experiments, and, as a mean of twelve successive ones, I obtained the following result:

Four gallons of milk, treated as above, produced, in twenty-four hours, four and a half pints of clotted cream; which, after churning only fifteen minutes, gave forty ounces of butter. The increase in the cream, therefore, is twelve and a half per cent, and of butter upwards of eleven per cent.

The experimental farmer will instantly perceive the advantages accruing from its adoption, and probably his attention to the subject may produce greater results.

MISCELLANIES.

THE PRETTY BIRDS—COMPLIMENT RETURNED.

Our readers will remember that we recently published a good article headed "Spare the Birds," at the same time expressing a hope that it would be heeded by every man and boy in the land. It was an earnest plea in behalf of the feathered tribe, based upon their natural rights, their usefulness in the destruction of insects, the gratification to the eye afforded by their plumage and motion, and to the ear by their music. The claims of humanity were also urged.

This publication was made on Wednesday morning last; and in the course of the day it was scattered far and wide. The joy and gratitude which it diffused among the birds, may be estimated from the fact, that on the following morning they waited upon the writer's family in a body, at his residence in New-Haven,—the number present being, as nearly as could be calculated, from 2500 to 3000. The blue-birds sent the largest delegation; next, the robins; then the canker-birds, snow-birds, &c. As it was impossible for so large a number to be received in person, the greater portion of them very considerately took their positions on the different trees and fences about the yard, while a sub-committee of about 250, comprising, say, 100 blue-birds, 75 robins, 40 canker-birds, and 35 snow-birds, with perhaps small representations from other tribes, presented themselves near the window of the sitting-room, most of them gathering around, upon, or among the branches of a young cedar 25 feet distant; and such a chirping, fluttering, and cooing,—such pretty colors and motions, have rarely been heard and seen before. Not only the sub-committee, but the whole delegation, from every tree and shrub and picket, raised a grand chorus, such as was never heard before, nor anything in comparison to it, by any who witnessed the celebration. The only mortifying circumstance is, that the *writer was not present*, (otherwise we should probably have a speech to report,) having been engaged at his usual drudgery in New-York. The sub-committee were however entertained in the best manner which circumstances would permit; an ample repast being provided for them,—for the cedar was covered with berries,—which they partook of with an

excellent relish, and appeared to enjoy the interview quite as much as did their honored guests. It continued for about two hours; when fearing that they should be burdensome, they withdrew, but repeated the visit on the following day, much in the same manner. The robins were uncommonly large and fat, and in fact the whole delegation, and especially the members of the sub-committee, were highly respectable in appearance, as we have no doubt they were in reality. They have our best wishes for their continued health and happiness.—*Jour. of Commerce.*

AMERICAN CHEESE.

At a meeting of the South Derbyshire Agricultural Society, on Saturday week, Mr. Colville, M. P., who filled the chair, drew the attention of the farmers to the import of American cheese, for the purpose of calming their fears. He showed that, although the import of American cheese had considerably increased, it had driven the Dutch cheese out of the market. He produced a table, which showed, that from 1831 to 1840, the importation from America had fluctuated, without any regularity, between nothing and fifty hundred weight; from Holland or Belgium the importation had increased, in the same period, from 133,397 hundred weight to 224,957 hundred weight; from other European countries the supply had remained insignificant and nearly stationary—1,049 in 1831, 1,464 in 1840: the aggregate importations advanced from 134,459 in 1831 to 226,462 in 1840. The last figures of the table we take as they stand: they show the imports of cheese, in hundred weights, from the places named for the last three years.

Year.	America.	Europe.	Total.
1841	15,154	254,995	270,149
1842	14,098	165,614	179,748
1843	42,312	136,998	179,389

The importation of cheese had decreased during the last ten years by nearly 32,000 hundred weight, while the population has increased by 2,300,000 mouths.

COW FEED.

M. Dumas made a report on some experiments made by M. Boussaingault, relative to the feeding of cows with beet-root and potatoes. M. Boussaingault states, that two cows which were fed exclusively on beet-root, fell off in flesh in seventeen days, nearly one-sixth, and their milk diminished from eight to ten litres per

day to five litres. They were then turned into pasture, and soon resumed their former weight, and gave the former quantity of milk. They were next fed exclusively on potatoes, when they fell off still more in flesh than they had done with beet-root, and the milk was reduced to two litres each per day. On being placed on a mixed food of hay, chopped straw, beet-root and potatoes, they again recovered their flesh, and gave the former quantity of milk. The conclusions of this gentleman are, that beet-root and potatoes do not perform the part usually imputed to them, of fattening cattle, or increasing the quantity of the milk of cows. His experiments show that this is the case, when this food is given to the exclusion of all others.—*London Athenæum.*

SALE OF AMERICAN HAY.

On Wednesday last, a sale of American hay, per the Liverpool, from New-York, took place on the north quay of the Waterloo Dock. The attendance was not numerous, though the bidding was, on the whole, tolerably spirited. The hay was considered of rather inferior quality. The quantity offered was 210 bales, divided, for the convenience of purchasers, into 21 lots, of 10 bales each. The first lot went off at 7½d. per stone; the next seventeen were knocked down at 7d., and the three remaining lots at 7¼d. Tare was allowed at the rate of 25 lbs. per bale; and parties were to remove their purchases on the day of sale. It was stated that there had been a loss by the sale of from 30 to 40 per cent. It will be seen, by reference to our London market reports, that another sale of American hay took place on Friday last in the metropolis. There, as here, the hay was not permitted to enter a bonded warehouse, owing to its being a combustible matter, which, in case of fire, occurring from spontaneous ignition or otherwise, would vitiate the insurance policy.

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